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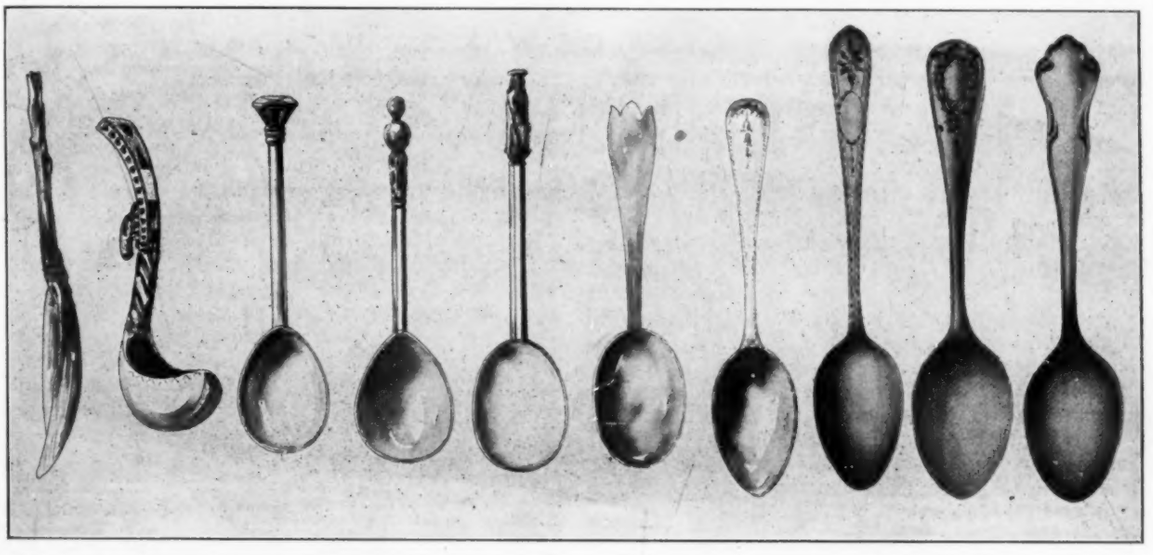
THE EVOLUTION OF THE SPOON.

By A. F. Saunders.*

The earliest domestic utensil known is the spoon and its gradual development from the shell scoop of the Barbarian through the bone, horn and wood period of the Middle Ages, the pewter, brass and silver spoons of later centuries up to modern times offers a most interesting and instructive study for the metal craftsman.

The spoon is an article so venerable that for its first mention we must go back to the days of ancient Egypt. The shell undoubtedly first suggested its form, and its first development began by inserting a shell in the end of a cleft stick, thus forming a handle. In these two simple steps we have the essentials of the spoon; the next step was to form the bowl and handle from the same material, either bone, horn or wood. Of the latter material we find splendid examples in the wood utensils, also the gourd spoon and scoops of the African Kafir, also the Indian of Central America. Many of these spoons are aside from their utility, objects of great beauty and possess real artistic qualities. The intricate and symbolic designs being delicately carved or scratched upon the surface in a most decorative manner, and though we make only a superficial study of this interesting development we are able to clearly understand the slow historic evolution of our domestic utensil, the spoon.

In writing of spoons one must remember of how much greater antiquity they are than forks, which were not introduced into England (from Italy) until about the year 1607, and one finds from old documents what an important part they played. The first mention of metal spoons on record dates back to the beginning of the Twelfth Century, in form, the bowls of these early spoons resembled the outline of the Plovers' egg, the pointed end toward the handle which was a round stem terminating in a plain knob or sometimes an acorn. The bowl was slightly below the level of the handle, although this difference of levels disappeared during the Fifteenth Century. The oldest silver spoon of this type now in existence so far as is known is the so-called Pudsey spoon, now preserved at Hornby Castle, Lancashire, England. It is claimed to have been a part of the personal belongings of Henry the Sixth, and dates back to about 1445. The top or head of this spoon forms a seal, bearing the badge of its unfortunate owner.



1 2 3 4 5 6 7 8 9 10

1—Original Spoon; shell attached to stick. 2—Carved Wooden Scoop; Scandinavian; A. D. 1200. 3—Pudsey Spoon; first type of metal spoon; A. D. 1445. 4—Virgin Head; A. D. 1446. 5—Apostle Spoon; A. D. 1500. 6—Hind's Foot, A. D. 1660. 7—Georgian; A. D. 1700. 8, 9, 10—Modern Spoon Patterns; based on Colonial Period.

Contempory with the seal top we find the so-called Maiden, or Virgin head, the handle here is surmounted by a head of the Virgin. The British Museum has in

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its possession one of these rare antiques, made of pewter, and it is claimed to be the oldest metal spoon known, dating back to about 1415, made during the reign of Henry the Fifth (1413-1422). During the Gothic period the handles became square or hexagonal and were surmounted with a small carved figure of one of the twelve Apostles, each with his appropriate emblem, occasionally a thirteenth spoon was added to this set and bearing a figure of the Savior and was called the Master Spoon. These Apostle spoons are the best known of old spoons to the general public. A complete set of thirteen is seldom seen, and if in good condition would realize a very large sum if offered at auction. For ages back the very first gift to a child was a spoon; this was the established present made by sponsor at christenings. This idea adopted during the Middle Ages shows clearly the influence of religion on the art of Mediaeval times, even the spoon was made to inspire religious truths into the minds of children.

The spoon was about the only article of plate possessed by the middle class in those days, and for about six hundred years every man, no matter how humble, desired to leave one to his descendants. The round stem type of handle continued in use throughout the Tudor period, though evidences of a variation in form began to show between the Fifteenth and Seventeenth Centuries. While the bowl practically remained the same the handle gradually assumed a flattened-out shape, and about the time of Charles the Second (1660-1685) this new style entirely superseded the old. The handle starting with a flat, narrow stem expanded at the head which was cleft into three points, from this feature it became known as the "Hind's foot." Another new feature also was introduced about this time, namely, the so-called rats tail; a long, sharply-pointed ribbed piece running down the back of the bowl, thus strengthening it materially. The bowl finally became elongated; this was the popular pattern until the time of Queen Anne (1702-1714) when a modification was effected by doing away with the three clefts, making the head of the spoon rounded, and the bowls became more pointed or egg-shaped with the point away from the handle. The so-called rat tail became shorter so that by the time of King George the Third (1760-1820) the spoon was the very acme of simplicity. The handle was inclined backward instead of forward.

These changes were due greatly to French influence as a type of extreme slenderness, pointed at both ends, had become popular in France during the Seventeenth Century. The fiddle-headed pattern introduced in the early part of the Nineteenth Century, and so named from its resemblance to the body of a violin, brings the history and evolution of the spoon down to the present time.

From the end of our Civil War until the beginning of our present century the tendency here in America had been to over-decorate and our spoon patterns have not been the exception, however, the number of really simple, yet charming, patterns seen in the shops today show the fact that the majority of buyers have learned to discriminate that bizarré effects are not as acceptable as simple things.

A LIST OF WAXES.

A Detailed Description of the Various Varieties Used in the Arts.

By D. J. Lemal.

(Concluded from August.)

VEGETABLE WAX.

All vegetables secrete more or less wax.

Japanese Wax.—Specific gravity unbleached is 1.002 to 1.006 and .970 to .980 when bleached. Melting point is 107 to 129 degrees Fahr. It is composed mainly of palmitine, is more brittle than beeswax and breaks with a clean fracture. It is sparingly soluble in cold alcohol, soluble in boiling alcohol, hardly soluble in cold ether, but soluble in chloroform, benzol, etc. Beeswax is rendered brittle when mixed with it; its melting point is also lowered. It is white or yellowish and hard and is obtained from the fruits of rhus succedanea (red lac sumach), also from other trees belonging to the anacardiaceae and is found near Nagasaki and Osaka.

Chinese Wax.—Specific gravity .970. Melting point between 179.6 and 181.4 degrees Fahr., and is partially soluble in alcohol or ether, but soluble in boiling naptha and crystallises on cooling. It is usually used for the same purposes as Japanese wax, but raises the melting point of most other waxes. This wax is obtained from the different species of rhus.

Carnauba (Brazilian) Wax.—Specfic gravity .995 to .999. Melting point between 181.4 and 186.8 degrees Fahr. It is a product of an exudation on the surface of the leaves of copernicia cerifera (carnauba or wax palm), which grows in Chile, Peru and Paraguay. The refined wax has light greenish-yellow color and has an aromatic odor on melting which you will recognize as the same smell on melting a wax phonograph record cylinder. On cooling, the melted wax cracks in all directions and has a crystalline appearance, added to beeswax it hardens and raises the melting point. A great quantity is used for phonograph records. It is partly soluble in boiling alcohol, ether and chloroform.

Sumatra Wax.—Melting point 141.8 degrees Fahr. This wax is found in the market nearly black outside and pale pink inside and is very porous. Added to beeswax it raises its melting point. It is insoluble in cold and soluble in hot alcohol, being precipitated on cooling in the form of a white powder, soluble in ether, chloroform and spirit of turpentine. It is produced by the tree ficus cerifera.

Bornea Wax.—Melting point 86 degrees Fahr. It lowers the melting point of beeswax. It is a nice looking yellowish wax with peculiar aromatic odor and has a crystalline texture, powdering when broken. It solidifies slowly after being melted. It is partially soluble in boiling alcohol, depositing on cooling needle—like crystals soluble in chloroform. It is obtained from the tree sophora.

Myrtle-Berry Wax.—Specific gravity 1.004 to 1.015. Melting point 116.6 to 120 degrees Fahr. It is obtained from the fruit of myrica cerifera, myrica caroliensis, myrica caracassana, myrica lacinata, myrica quercifolia and myrica cordifolia. It has a hard greenish-yellow appearance and is partly soluble in cold alcohol and ether.

Otober Wax.—Specific gravity .920. Melting point 97 degrees Fahr. In color it is a yellowish-white with a greenish tinge. It is softer than beeswax and is soluable in either and boiling alcohol. Sometimes it is called ocuba wax.

HINTS ON BRASS FOUNDING

By W. R. Dean.

W. R. DEAN.

The requirements of a modern brass founder are more than they used to be a decade ago and it requires more study to successfully manage a modern brass foundry and keep abreast of the times. It was not so very long ago that all that was required was to be able to take a crucible of metal out of the fire, make a good mold and pour it. Scrap was of better quality and more free from the class of metals that cause trouble for certain lines of work; prices were higher for the manufactured article and the founder could have more "to go and come on" in the way of finish, etc. Competition was not so keen and one did not have to look into the cost so carefully. Now to be a successful brass founder, it is essential to know metallurgy, foundry economy, estimating, how to figure piece work prices, how to get the most out of the men, to be a good molder and mechanic and how to surmount the many obstacles that are constantly arising.

There are many large successful foundries that have a metallurgist at the head and he has a practical molder under him. If the head man has worked himself over the bench or on the floor he is apt to know what constitutes a good day's work and can show the molder how to overcome difficulties and make the mold for a large and difficult casting. For small bench or machine work a good mechanic with a fair knowledge of molding and sometimes seem almost insurmountable. For example; take Figs. 1, 2 and 3. Here is a pattern that was so high that the only available cope, H H Fig. 3, was not deep enough, so a check had to be built of bricks and iron plates shown at K K Fig. 3 and E Figs, 1 and 2. This is a pattern for a condenser cover for the condenser of a large battleship and is to be made of a mixture of 88 copper, 10 tin and 2 zinc, and will weigh about 3,800 lbs. The construction of this mold takes about three weeks. I will go into it in detail later.

There are a good many troubles arising in the brass foundry and it takes a thorough study of conditions, and the constant attention to the scientific principles of molding and melting to eliminate them. Of course all defects in molding and melting cannot be done away with, but they can be remedied considerably. We can strive for perfection but we will never reach it. One of the best and quickest ways to lower the percentage of loss castings is by the efficiency method. This method was ably spoken of by Mr. Benjamin Fuller in a paper at the Detroit convention held last year by the American Brass Founders' Association. The efficiency method is applicable to any kind of a shop but more so to the larger shops where details cannot be kept in the head. Many a large foundry of 25 or more molders is run without

FIG. 1. VIEW OF MOLD OF CONDENSER COVER.

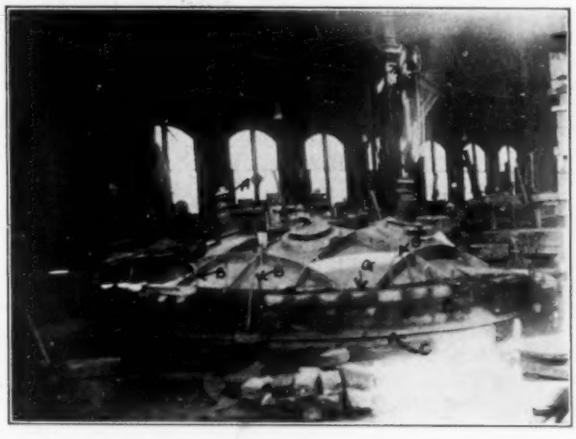


FIG. 2. THE SAME MOLD AS IN FIG. 1, SHOWING BUILT-UP CHEEK PIECE.

plenty of knowledge of metals can point out to the average bench molder his troubles and can show him how to remedy them. But when it comes to large work where many obstacles have to be overcome and many molding troubles arise, here is where a good mechanic and expert molder is necessary so as to rig up, read the blue prints, make the draw plates, draw backs, etc. Often a casting is made now in dry sand or in green sand and skin dried that used to be made in loam. Sometimes the pattern is of such character that a flask suitable is not available and the foreman does not want to make a flask for this one job, so he is called on to overcome the difficulty in other ways. For the small brass founder never having had to make this class of work these difficulties any semblance of a system or a check of any kind, using some makeshift methods to keep tabs on the amount of work done by the piece workers.

The foreman has to do the best he can together with the many other details to be attended to. The foreman is unable to keep in his head a lot of figures and as he has no records to refer back to he has to trust to memory. This is especially bad in a specialty shop. For instance, suppose a foreman has a job to give out, the pattern for which has not been in use for several years and it is rather hard to get all the castings, and should go to a man who has had experience on it to have good luck. After having given out several thousand patterns for the intervening years he has forgotten who had the best luck,

but if he has his cards to refer back to, providing, of course, the moulders don't keep shifting, he can give it out to the same man and can tell him from the cards what his main trouble was when he made it before. When the average loss is only 6 or 7 per cent. and you are trying to get it down to 5 per cent. or less then the cards are mighty handy.

For an illustration, suppose by our cards, Fig. 6, we find A made a job eight different times for a loss of 4 per cent., 6 per cent., 5 per cent., 4½ per cent., 7 per cent., 4 per cent., 4½ per cent. and 4 per cent. B made it five different times with an average loss of 5½ per cent., while C's average for four times was 8½ per cent., D's average was 11 per cent. for three times and E's was 4½ per cent. for six times. This shows us that we can choose between A, B and E while we keep clear of D and C for this particular job. It also shows that E's average was the best so if E is available E gets the job. By this method our loss can be kept down. This entails clerical work, but it pays; for instance, suppose in a shop melting 5,500 to 7,000 good castings per day we have a clerk and pay him $25 per week, and we can get one for less, and our loss was 10 per cent. by the use of the cards as a

FIG. 3. THE COMPLETED MOLD, SHOWN IN FIGS. 1 AND 2.

help we reduce our loss to 6 per cent. we save $6.50 per week over the clerk's hire or $338.20 a year. On the record cards are shown what caused the loss each time and it can now be remedied.

Many a large specialty shop, such as a shop making plumbers supplies, etc., is run without keeping an account of the percentage of defective castings, and this often results in a misunderstanding. This keeps the foreman in hot water continually. The superintendent or manager depends only on word of mouth for information or by the occasional glance in the cleaning room. He may strike a day when quite a few have gone bad, but a glance at the cards shows that the average is low. Sometimes he gets his information from an unthinking foreman from some other department. The foreman has been having trouble and the superintendent asks him how the castings are coming and the foreman unthinkingly says, "Very bad," when they are coming very good as the cards might show. The cards don't lie, but give actual facts, no more and no less. An inspection department to inspect the casting just after leaving the cleaning department would more than pay for itself because it would bring to the foreman's attention immediately the troubles in the castings and it could be stopped before the whole order was filled.

It is a great mistake to expect a foreman to do his own inspection in a large shop; for in doing this he lessens the time that he should devote to remedying troubles. When a foreman has to give out the work for 25 or more molders and attend to a thousand and one other things that come up during the day, he is not always apt to spend as much time looking over thousands of castings as is necessary to find all the bad ones.

Fig. 4 shows a sheet that will give the Daily Defective Casting Report. The bad castings are separated by the inspection department, weighed and counted and the weights and count and pattern number given to the cost clerk

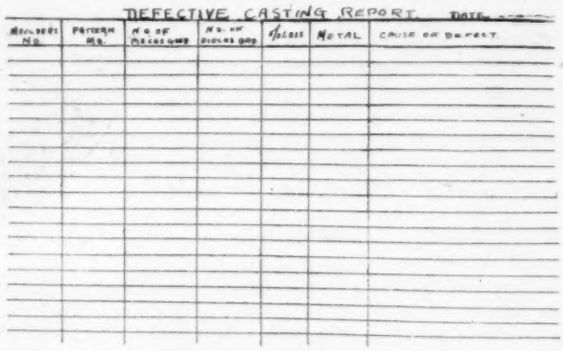


FIG. 4. SHEET FOR DAILY DEFECTIVE CASTING REPORT FOR COST CLERK.

to work up. First he gets out a sheet or card which is worked up quickly and indicates the different workmen to whom it goes, as it is duplicated with carbon paper, just what the loss is. Fig. 5, while the foreman has this to look at and the cost clerk works up the sheet shown in Fig. 4. After these sheets are looked over and the cause put in the proper place in Fig 4 (cause of defect) the clerk can go ahead and work up Fig. 6. This shows the card system for referring back to find out the efficiency of the molders. This is arranged like any card system and is kept on file in the cost clerk's office.

For keeping the chimney loss in melting Fig. 7 gives you an idea if you keep the other sheets, the bad castings, spoiled castings, etc., can be left off and the castings are

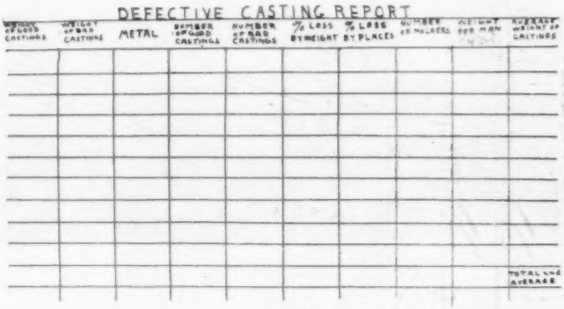


FIG. 5. SHEET FOR DAILY DEFECTIVE CASTING REPORT FOR FOREMAN.

charged in as returned castings. These castings are what comes from the factory after having passed the inspection department, they are from leaks at pump or flaws that show up after machining. In the summary on Fig. 7, the defective casting weight per man, loss in pounds and per cent. of loss are left off if the other sheets are used. This sheet (Fig. 7) was a general one and the only one used. The defective castings were what was thrown out by the foreman or the cleaning department, a good many went to the machine rooms and a lot of labor was spent in machining them, as the machine man wouldn't throw

out the bad ones first. The inspection department would stop this to a great extent.

All castings sent back weekly by the other departments could be assorted and a separate sheet made out giving percentage of loss in factory and be a weekly report.

From these sheets the foreman knows just where he stands and can look up each defect and remedy it accordingly. For instance, suppose a large percentage of loss

PATTERN NO.....

MOLDERS NUMBER	DATE	NUMBER OF GOOD CASTINGS	NUMBER OF BAD CASTINGS	%LOSS	CAUSE OF DEFECT

FIG. 6. SHEET FOR RECORD OF EFFICIENCY OF MOLDER.

was from oxide or pin holes, he would know something was wrong in the melting department and could straighten that out. So on in this way and soon the percentage of loss would be very low. The foreman soon knows whether he is making good or not and so does the superintendent or manager. The manager knows by not leaving his desk and he does not have to ask or watch any one, for the daily sheets show him at a glance the true state of affairs. A foundry foreman should know the workings of different foundry cost or efficiency systems so as to install one or help install one if none exists and should always be in sympathy with such a system.

It is easily shown, if one cares to figure it out, the saving in costs, etc., brought about by some efficient system. It will soon lower the percentage of loss, as many who have a system can testify. By these reports the superintendent can mark a glaring defect and it is apt to sink in when the foreman sees it, and results are soon shown, or the foreman knows he should look for another position as something is wrong.

Many surprises are in store when a system is first installed as the percentage of loss is far greater than was expected. A foundry foreman should know how to estimate, for often in the jobbing foundry he is called on to help in estimating on a job. He should be able to give a good idea of the molding time required, rigging or flasks to be made, time he can deliver it in and labor cost in melting, etc. He must be able to tell pretty close to actual cost so that the one submitting the figures can figure a fair profit and land the job.

It is time now to leave cost accounting, etc., and pass to what many consider the real difficulties of the foundry. The most important item in a brass foundry is the metal; for without metal there would be no castings. If a foundry foreman is not a metallurgist he should be thoroughly familiar with metals. He should know the characteristics of all the virgin metals used in a foundry and how to proportion them to get different physical properties. He should also know how to fill orders with as few different alloys as possible. It is a grave mistake to have a lot of different alloys, that is 25 or 50 when 12 or 15 would fill the bill and greatly lessen the general work of the foundry force.

(To be continued.)

DAILY FOUNDRY REPORT

METAL CHARGED DATE

NO. 0 INGOT BRASS	NO. 1 INGOT BRASS	INGOT COPPER	OLD COPPER	PROD. COPPER	LEAD	SPELTER	TIN	NICKEL	DEFECT METAL	ANTIMONY	PIGS	GATES	CHIPS	BAD CASTINGS	SPOILED CASTINGS	MISC. CASTINGS	SUNDRIES

METAL RECOVERED | SUMMARY | COAL and COKE

	CASTINGS		PIGS	GATES	SCRABBLE	CHIPS	TOTAL	GRADE	TOTAL METAL RECOVERED	DEFECTIVE CASTINGS	WEIGHT PER BAR	LOSS IN POUNDS	LOSS PER CENT.	
														AM'T. COAL USED
														" COKE "
														" COAL PER 100 LBS. METAL
														" COKE " " "

FIG. 7. SHEET FOR SHOWING COMPLETE FOUNDRY REPORT.

THE CRYSTALLIZATION OF CAST METALS*

By Cecil H. Desch, D.Sc., Ph.D.

When a metal is melted and allowed to cool, it changes into the solid state by a process which is exactly similar to the freezing of water, or to the crystallization of a salt from a solution. If we do not always realize this fact, it is because the process is less easy to observe in metals. We can see the crystals of ice forming on the top of a pond or a puddle, we can see the deep blue crystals forming in a solution of copper sulphate. But metals are not transparent, and the crystallization goes on mostly out of sight, until the whole mass of the metal has become solid. There are two ways in which we can become aware that this mass is built up of crystals. We may break the metal across, when we see that the fracture presents a number of glistening faces, or we may cut the metal through and examine the cut surface with the aid of a microscope. This second way tells us much more than the first, and it is in this way that most of our knowledge of the crystallization of metals has been obtained.

Common salt crystallizes in cubes, and when a small cube has been formed, it grows by the addition of more salt on each of its sides, so that it still retains the shape of a cube. Crystals are not always formed in this way. In those beautiful crystals which make up an ordinary snowflake, the particles of ice grow in the form of a star, usually with six branches. These branches shoot out from a center, and as they become longer they throw out shorter branches on each side, but always keeping a symmetrical form. The result is that instead of a cube or other regular solid, we have an elaborately branched skeleton. The crystals which metals form when they solidify are skeletons of this kind, only, instead of being perfectly symmetrical, like snow-crystals, which are formed in undisturbed vapor, they are always more or less distorted and one-sided. The crystallization starts at a number of points, and if each skeleton grew equally in all directions, the solid metal would, in the end, be made up of a number of little solid masses, all similar in form. This regularity is disturbed, because the metal does not cool at an equal rate everywhere. In an ordinary casting, the metal next to the surface of the mold cools first, so that the first crystal centers are formed there, but they can only grow inwards, and the skeletons formed are always elongated in that direction. First, a long rod or central rib shoots out from the cooling surface into the mass of the liquid metal, then this rod gives off branches sideways, and these again branch, until a very complicated skeleton is formed. Such a crystal has a structure somewhat like a fir-tree, with its trunk and branches, or in other cases it reminds us rather of the fronds of a fern. As the metal becomes solid, the spaces between the branches are gradually filled up, and the structure apparently disappears. Occasionally it may happen that all the liquid metal has been used before the filling-up process is complete, and then the trunk and branches are preserved for us in their original form. This happens when considerable piping occurs. Beautifully formed "fir-tree" crystals of steel have been found in the pipes of large steel ingots, the shrinkage of the metal during cooling having left the crystal skeletons projecting into the cavity to a distance of a foot or more. Similar crystals, on a smaller scale, are common in the piped heads of castings of many metals.

Apart from such accidental occurrences as these, we can easily reveal the manner in which a casting is built up of crystals by cutting a section through it, polishing the cut surface, and attacking it by means of an acid. In most commercial metals and alloys the material which solidifies first has a different composition from that which remains longest fluid, and although the whole mass appears uniform when it is cut and polished, we find that the acid attacks it unequally, so that the original pattern is etched out and becomes visible. If we apply this process to a casting, we find the "fir-tree" structure very conspicuous, the base of the trunk being in contact with the mold, while the trunk itself is directed inwards towards the center. We find also that the growth of each "tree" is limited by that of its neighbors. When the growing branch of one skeleton meets a branch of another skeleton, it ceases to grow, and a boundary, more or less irregular, is produced. This boundary is evidently the weakest place in the mass, and the strength of the metal will largely depend on the direction it takes. If the branches of neighboring skeletons "interlock," the boundary has a zig-zag form, which assists the adhesion of crystals to one another, but if adjoining crystals all lie in the same direction, so that the boundaries between them are nearly straight, the metal breaks along those lines as soon as it is strained. It is for this reason that square corners are avoided, for instance, in hollow castings. The crystals grow chiefly at right angles to the surfaces, and where, as at a corner, two sets of crystals meet, a sharp boundary, which is almost a straight line, is formed, and the casting easily breaks along that line. If the corner is rounded instead of being sharp, there is a gradual change of direction of the crystal skeletons, and such lines of weakness are avoided. In chill castings, crystallization takes place from a greater number of centers, and proceeds so rapidly that there is not time for the long skeletons to be formed, hence the crystals in such castings are smaller, and their boundaries more irregularly arranged, than in castings which have cooled slowly.

The process just described is all that occurs in the crystallization of a pure metal, or of certain alloys, such as cast brass of the best quality. If the brass contains certain impurities, such as lead, these impurities remain liquid until everything else has solidified, and at last form little isolated masses between the crystals. The strength of the casting depends in a large measure on the arrangement of these masses. Lead in brass, for example, collects in little globules, which do not materially weaken the metal if only present in small quantity, while bismuth forms thin, highly brittle films between the crystals, preventing them from adhering to one another. For this reason bismuth is a far more dangerous impurity in brass than lead.

Besides such casual impurities, many alloys, and most irons, contain constituents which normally remain fluid after the greater part of the mass has solidified. Without entering into details, we may say that the part which remains longest liquid is known as the *eutectic*. Consider, for example, a grey iron containing 1 per cent. of phosphorus. The greater part of the phosphorus remains in the eutectic, and appears in a section in the form of brilliantly white patches, con-

*Paper read at British Foundrymen's Association annual Convention, Glasgow, Scotland, August 8, 9 and 10, 1911.

sisting chiefly of phosphide of iron, lying between the crystals of iron. This phosphide is hard and brittle, and contributes to the brittleness of the iron.

We may next consider a white cast iron, a material which gives some of the most beautiful of crystalline patterns when examined with the microscope. The first crystal skeletons consist of iron, holding a certain quantity of carbon, as well as small quantities of other elements, in solution. These skeletons are excellent examples of the "fir-tree" type of structure. The space between their branches is filled up by the eutectic. Microscopical examination shows that this eutectic is made up of two constituents, one of which is of the same nature as the original skeletons, while the other is the white, exceedingly hard carbide of iron. This duplex structure is characteristic of eutectics.

Where the eutectic forms so large a proportion of the whole as in white cast iron it unites together the different crystal skeletons in a way that is obvious from an inspection of the structure.

Two points in the structure of alloys containing a eutectic are remarkably well illustrated by the example of white iron. The first is the remarkable arrangement of the two materials that make up the eutectic. It is easy to see that their particles are not distributed haphazard, but that the darker constituent forms bundles of parallel rods, which appear to the eys as groups of dots if the section happens to cut across them, or as lines if they are cut lengthwise. This parallel arrangement appears in various disguises in the most different alloys, and we can sometimes ascertain with certainty that it is governed by the direction of the main crystal skeletons. It is responsible for the great beauty of the banded structures in many eutectics. This directive power is so great that masses of eutectic may sometimes grow in such perfect parallel arrangement that they take on the form and appearance of single crystals. Certain Swedish white pig-irons high in carbon, for example, contain large flat plates which have every appearance of being true crystals, until a microscopical examination shows that they are really masses or "colonies" of eutectic grouped as just described.

The second point relates to the form of the crystal skeletons themselves. We commonly think of crystals as having characteristically sharp angles and flat faces. There are some exceptions; native diamonds, for instance, commonly have curved faces, but the rule is a general one. We see, however, that the crystal skeletons in white iron have no sharp angles, but rather present the appearance of chains of oval masses, like drops of a liquid. Such a peculiarity is by no means confined to iron, but is found in most metals and alloys. A few metals, such as bismuth and antimony, and a few of the hard and brittle compounds which metals form with one another, have sharp angles at the ends of all their branches, but these are exceptional. It would appear that when a metal is crystallizing from the fluid state, two forces compete with one another in determining the form that it takes. One force, the same that produces the globular shape of drops of oil in water, or of mercury spilt on a table, tends to draw the metal into globular or oval masses, while the other, the crystallizing or directive force, tends to group the particles in definite straight lines having certain fixed directions. The actual shape of the crystal skeletons depends on the degree to which the one force is able to overcome the other, but the conditions which govern the process are among the most obscure problems of metallurgy.

The author cannot hope that these few observations have any practical value in relation to foundry practice, but he would express his conviction that an acquaintance with the structure of cast metals—the way in which the bricks are fitted together, so to speak—is of the greatest value in any attempt to solve the difficulties which occur in respect to the strength or weakness of castings, and he would also urge that the microscope as a means of controlling foundry practice deserves more consideration than it has yet received, except in a few quarters. Rolled and worked metals are microscopically examined as a matter of routine to a rapidly increasing extent, and an extension of the practice to cast metals is in the highest degree desirable, as this form of investigation will go a great way in solving what are now puzzling problems.

CENTRIFUGAL PROCESS OF ZINC-COATING.

By Robert Grimshaw.

(The word "galvanizing" is misleading to foreigners, applied falsely as it is by us to express a process which is purely mechanical, and has no more to do either with galvanic currents or with any process invented by, or made famous by, Galvani than making buckwheat cakes. And as the zinc-coating of sheet metal and other metal articles is now just as well, if not much better, effected by a real "galvanic" process than by dipping them in a bath of melted zinc; and as tin-coating by dipping in melted tin is not called "galvanizing," I suggest that we drop the word in question from our vocabulary, and use one which corresponds to "gilding," "silvering," "tinning," etc.)

There has been recently patented in Germany a process for coating articles with zinc by a heating process, which is claimed to produce neat, clean and regular results, and which may be briefly described as follows:

The articles to be zinc-coated are first pickled to remove scales, and after being put in the bath of melted zinc are rotated about a vertical axis. The use of "centrifugal" (which might much better be called "tangential") force for freeing zinc-coated articles from superfluous zinc while the latter is still fluid, has been already known and applied; but as far as I know only to wire and the like, which, after being dipped in bundles or coils in the bath, are then whirled in a separate containing vessel. Where, however, there is a great number of small articles which cannot be handled in bundles, as wire cans, much time is lost in the transfer; and there takes place a cooling of the metal deposit, sufficient to prevent thorough removal of superfluous zinc.

The application of a heating device to the centrifugal machine, or to the vessel thereto attached, would increase the complication of the process and the accessibility of the apparatus.

A more simple method is to place the articles to be coated in a vessel with perforated lateral walls, and to dip this, together with its contents, in the zinc bath. This "basket" and its newly-coated contents are then rotated at the desired speed to drive off the superfluous coating before it has had time to cool. The advantage claimed for this procedure is not only that time is saved, and complication avoided, but that the containing vessel acquires the same temperature as the bath and the articles to be coated.

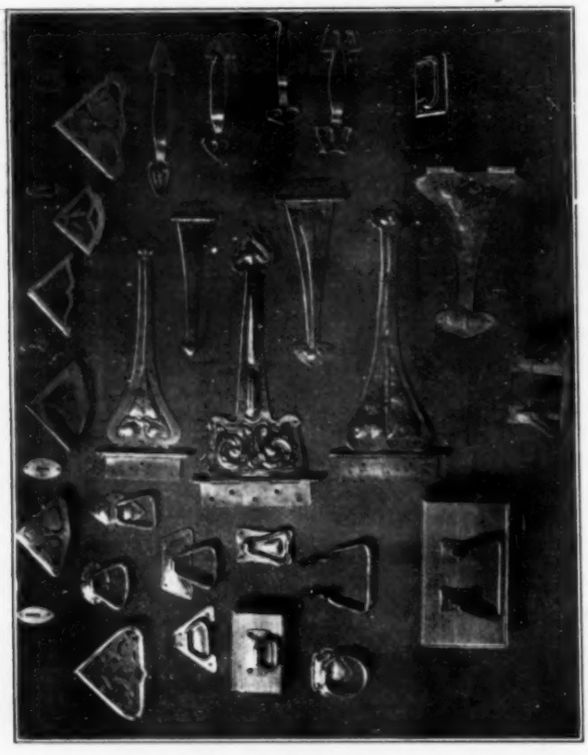
ARTS AND CRAFTS WORK ON COPPER AND BRASS.

SOME OF THE LATEST EDUCATIONAL DEVELOPMENTS OF THIS INTERESTING ART.

BY CROMWELL CHILDE.

The oldest of the metal working arts is the latest thing that is being taught in the public schools to-day. From everywhere in America there is coming a demand for copper pieces of Arts and Crafts design, for young men and women that can turn these out, not only well technically but with an artistic sense and touch. But more than all there is a constant inquiry for teachers who can teach the young how to do this work. Hitherto the teacher supply has been limited. The next year or so will see it greatly increased, for the new field has a very broad and most promising outlook.

The young man or woman who learns the new art to-day and acquires a reasonable degree of facility and taste in it in almost any part of the United States just now has his or her future assured. He or she



EXAMPLES OF ORNAMENTAL ART CRAFT WORK.

will find no difficulty in getting an opportunity to teach, for more and more of the grammar and high schools, East and West, are adding metal working departments along Arts and Crafts lines. Or he or she can set up a small shop and turn out products to be sold over the counter as soon as finished. It is calculated that any artistic copper worker can easily clear from twenty-five to thirty dollars a week at the start.

The opportunity for the younger generation is now just being fully appreciated by progressive educators. The art is one readily to be learned, provided the beginner has a natural capability and clever, artistic fingers. Those who have carefully studied this new American artistic coppersmithing and the human material that seems to be available for it report a very great amount of ability latent that needs only proper direction and inspiration. They say that the enthusiasm shown by those who have taken up the fashioning of copper is amazing.

The chief thing interesting about this art that now with a rush takes hold of the schools of America and bids fair to become a greater and yet greater educational specialty is that it is purely handwork and success lies in the individual artistic taste and adaptiveness of each operator. The schools are not going into machine work or what is known as "commercial work" at all. A few simple tools and a work bench are all the "plant" required. Personal cleverness and deftness in touch are what are required for success, and there is this that gives the new art—for it has fairly become that—its importance to the public school youth, that even fair, ordinary ability can produce marketable results and earn a good living. The young man or woman need not necessarily be an artist in copper to succeed, though, naturally, the more art the greater success.

At the moment those who have the future of Arts and Crafts coppersmithing chiefly to heart and are desirous of seeing it grow quickly into a great American public school specialty are concerning themselves

SOME USEFUL ART CRAFT WORK DONE BY STUDENTS.

with the instruction of teachers. Literally scores more men and women with this special knowledge could find places in the school systems to-day. Up to now teachers have been difficult to secure. This has had its advantages, for with very few exceptions the men who have been found to teach have been thoroughly practical and able, in nearly every case men with shops of their own and with vast funds of experience to draw upon. Thus the system of instruction has been started right and has been put on a thoroughly business-like and solid basis, with nothing of the theoretical in it. Those who have learned from these men and will in their turn teach are having this same spirit and these ways of the trade, now specialized into an art, communicated to them.

One of the places where Arts and Crafts coppersmithing is being most thoroughly and artistically developed to-day, with a view of turning out teachers for public school children, and also for the making of real artisans in the work, is Teachers' College, New York, a part and portion of Columbia University. About fifty pupils are here taking the regular course in metal working and a surprising high degree of excellence is being developed. Arts and Crafts coppersmithing, as it is working out along American ideas and ideals, is building up slowly but surely into a great American art. There is no hard and taxing physical work about it; it requires, in the main, dexterity of the fingers, industry, thought and taste. It is an art fitted alike for both men and women, those who

have knack of design and ability of fashioning ingrained within them.

Some of the most apt pupils are apprentices in sheet metal shops. While there is some professional element in the classes the men are largely interested in the Arts and Crafts side of the work, because it pays the best. They take an especial interest in the technical end of the art, the equipment, the use of chemicals, etc. They are unfailingly good and keen workmen, have the best equipment of tools and an interest that makes them take the best care of them. In the Teachers' College not a few of the most promising pupils come from this source. There are regular college year classes, and the bulk of the students are planning to enter the trade as producers quite as much as to qualify as teachers. But in summer a special class is run for the benefit of would-be teachers in general. This year, for the first time, this class promises to be very large and active. Applications to enter it have been made from all sections of the country. The students for the most part are already teachers, largely in the public school service, who see great possibilities ahead for them if they can qualify in this work.

The classes at Teachers' College are very complete. They are so planned as to teach the art of coppersmithing in all its branchese. They do not, it is true, attempt to compete with the four years' apprentice course in the trade schools, but as far as the lighter side, the purely non-mechanical end, of copper work is concerned, get the student to a point where the apprentice would leave off. The proposition is, of course, quite different from that of instruction in the coppersmithing trade, for here only hard work is taken up. Among the features of instruction in these classes are the smaller problems that arise, the technical points that go into the construction of the scores of beautiful little objects that may be made out of copper and for which there is unfailingly a great demand. These are not the great problems that would arise before the apprentice in a big copper working shop, but problems distinct and of their own importance, though very different. Thus the young woman or the young man taking up this work either to directly produce or to teach must learn the use of the saw, must be given instruction in filing, soldering, copper plating and enameling. Those who have studied into these things say they are fascinating in a high degree and that brains count equally with finger dexterity when it comes to applying the theory.

What is chiefly aimed at in these classes, especially when it is teachers that are to be taught, is to so firmly instill the elements of the art that the teachers when they go out will not make mistakes. There is much responsibility in these pioneer classes, for the students that go out from them will teach as they have been taught. Hence throughout each working day each "job" of each student is most thoroughly inspected as it progresses and everything is carefully pointed out, particular attention being paid to a "fall down" at any point. Along with the instruction in tools and processes goes a course in the preparation of the material before it is worked, how to anneal it, etc. This is an important side of the art and yet easily learned after a few lessons.

What is of first importance in this work in art metal—for the making of dainty utensils and novelties in wrought iron and brass may be taken up at the same time and alongside of it, and really forms part of the training, though work in copper has the call—is the fact that the capable young person may learn it readily and find himself or herself equipped with a very good profession. The demand for copper articles is proving so great that by turning out articles with true individuality to them a young man or woman could set up in his or her own town and be assured of an income of a thousand dollars a year, if not indeed fifteen hundred, to start with. This is the advantage of work along artistic lines. The youth who devotes himself to big commercial work would find it difficult to get over $15 a week for some time. Handwork, though, distinct from machine made articles, always brings its own price, and this is especially true of specialties in hammered copper, brass, etc., that can be distinguished at a glance from the products of the great establishments whose machines throw out work by the hundred, the pieces perfectly similar in every detail.

The schoolmen of America who are now thinking along practical lines have this situation well fixed in their minds. They have already established, wherever possible, classes in metal working in the public schools, and the outlook is that the new field of instruction is going to be immeasurably widened in the near future. It is more than anything else now the securing of thoroughly competent instructors, and this lack is soon to be met. One of the encouraging features of the situation is that in this summer's classes in Teachers' College, Columbia, there have already been enrolled several teachers from California. They see the need of metal work instructors out on the Pacific Coast, and they are hastening to prepare themselves to fill the void.

DISTRIBUTION OF THE CLASSES.

The classes in the public schools are as yet unevenly distributed. Some cities have not as yet fully realized the situation, others have not been able to secure proper instructors thus far. But all are awake as to the importance and the certain rapid development of this new field, and here and there wonders have been even now accomplished. In Newark, New Jersey, at the Sophie Fawcett School, now a public school, some admirable work along these lines is being done. New York is becoming a genuine center of art metal work activity in her schools. Spurred on, it is quite likely by the work in Teachers' College, classes that are really accomplishing are in full operation in the Boys' High School in Brooklyn, in Cooper Union, in the Brooklyn Polytechnic and in the trade schools of the New York University.

In Philadelphia a little work of this order has been done in the public schools. In Boston a great deal of it has been done, both in the public schools and in the high schools, fostered and pushed by the Boston Arts and Crafts Society. Boston is not far from holding the lead in instruction in art metal work at the moment. Its schools are excellently equipped, its specialist instructors very capable and a very high grade of young, artistic workers are coming out and earning good money at the beginning of their careers. This is a satisfactory test of the new field and its development.

But art metal working in the public schools is by no means confined to the East. Lately the schools of Chicago, Minneapolis and St. Louis have taken it up and are becoming thoroughly enthusiastic over it. These cities feel the need of competent instructors severely, and on this account, and this only, the work is not moving forward as rapidly as it might. But that is already being looked out for and in a few

months will no longer delay the developing of the work. This summer teachers from all these cities are to come into New York to take the special courses open to them. Next year's programme, it is anticipated, will move along very briskly, and a great deal will be accomplished. This work is a thoroughly practical thing for the schools to take up because the equipment it not at best costly. No great shops are needed, only a relatively simple plant. It must be recalled that no machinery is needed for this handwork. What will be found in the schoole thus far equipped—and it is quite adequate—are benches, gas for the blowpipes, vats for annealing, in addition to tools and a supply of sheet metal.

All the schools issue the sheet metal that is used to students at actual cost. In many cases the schools also furnish all the equipment of tools, always a working percentage of them, but not a few of the students augment the school stock with additional tools they own themselves. The work, both school teachers and pupils say, has so many fascinations that the pupils become interested beyond all measure and gradually pick up a set of tools themselves, some getting together ever so many for all sorts of fine work. In fact it is growing so that a pupil's enthusiasm may be largely measured from the stock of tools he or she has acquired personally.

THE OUTFIT NEEDED FOR WORK.

Quite a little "kit" is needed for the proper handling of this Arts and Crafts metal work. While it may be possible to get along without some of these, the following list presents what the young man and woman who plan to become proficient will have to get, perhaps not while in class, but certainly when he or she stocks out his or her shop:

Scratch awls, 2¾ in. long; piercing awls; straight and circular snips, 10, 11 and 12 in.; jewelers' snips; telephone snips; flat nose pliers, 4½, 5 and 6 in.; round nose pliers, 4½, 5 and 6 in.; end cutting nippers; diagonal pliers; tweezers; jewelers' saw frames and 12 in. blades; hack and saw frames; files; chasers' hammers and handles; riveting hammers; horn hammers; rawhide mallets; cabinet-makers' clamps; foot bellows; blowpipes; silver solder; wire solder; soldering coppers, 1½ and 2 lb. to pair; hand vises, 4 in.

The lure of copper working is beyond all measure. and it is an art that grows and grows upon the art artisan. Such an infinite number of pretty articles can be fashioned from the metal. Their number and variety are almost illimitable. Beautiful as were the products from the old English coppersmithies, many of which sell at enormous prices to-day, it is possible for the workers now to far surpass these in artistic merit. The possibilities of handwork of the highest grade, turned out by well trained young fingers and brains, are only just commencing to be realized. There are so many things that can be made, things artistic and yet useful. The range is the widest possible. The Arts and Crafts metal worker may turn out bowls of every shape and design, tea kettles, coffee pots, frying pans, sauce pans and pudding pots, coal scoops, vases, preserving pans and coal hods. He is not hedged in by traditions, nor does he have to consider what has been done before. He may utilize his own judgment, develop his own artistic sense, and the more he does this the finer the product will be and the higher his remuneration.

It is opening up a new and hitherto little touched field of work for the American boy, one of especially great possibilities, because the products from his shop will not be so costly that only the rich can buy them, but will also be open to the people of moderate means. The market of the metal producer is great. More and more it is recognized that household objects of copper offer decided possibilities of decoration and have unbounded useful qualities besides. They are unbreakable and they last for all time. More than that, they give a special charm wherever they are placed. People of taste cannot seem to buy too many of them. The Arts and Crafts training up of these young men, now that it is commencing to be on a large and wide-reaching scale, marks almost a new era in metal production. It means a new type of workman, one that does not conflict with that already established and prosperous, but a man with an entirely new field that means increasing revenue to himself.

PATTERN SHOP NOTES.

By W. H. Parry.*

If you should receive an order for a fancy name plate, do not attempt to chew it out of hard wood or send it out to some other fellow who is handier than you at carving or designing; if possible get a drawing of what is wanted, or, failing in this, get the party who is paying for it to give you some idea of what he wants, even if you have to use a corkscrew, metaphorically speaking. Then once the size of the plate is determined, make it, and place on it a layer of ordinary beeswax the thickness of the letters or figures, lay out roughly the design and remove surplus stock, and if you are any kind of a patternmaker you will make an excellent job in much better time than if you tried to carve it out of wood, and if you make a few mistakes, why just take off or add on a little wax here and there, and the result will astonish you. I know it did me at the first attempt, and nobody every accused me of being a designer of fancy name plates up to that time, while now, I throw an awful chest at the game, and as long as those outside our business think it's all right, I'm sure we ought to. May be some time you are shy of number 00 sand paper. Don't get cold feet, but rub two pieces of number 0 sand paper together on a couple of blocks and a pretty fair grade of 00 sand paper will result.

The man or boy who uses heated metal to run wax fillets into corners or to fill up nail or screw holes, except in zero weather, should be sent to the foundry to riddle sand. Just use a piece ¼, ⅜ or ½ inch dowel about seven inches long, shaped like a round nosed turning tool on one end and wedged shaped on the other, then smear some ordinary machine oil on both ends, and get busy. You will find that beeswax can be shaped any old way with these sticks, though the wax should never be applied unless there is at least one coat of varnish on the pattern, and when, from practice, you get clever, there will be no need of sand papering over the wax before applying another coat of shellac. Did you ever notice your boy puttying up screw or nail holes, and trying to form the putty so that it will be flush with the surrounding surface? You know what happens, don't you? First he shoves it to one side, then to the other, and the hole is only half filled after he is through with it. Now if you hand him a piece of leather belting, about an inch wide, or even the back of a piece of leather fillet and tell him to rub rapidly, you will be surprised at the beautiful surface it leave, and, strange to relate, the hole will be filled perfectly flush. The skin side of the leather should always be used while doing this stunt.

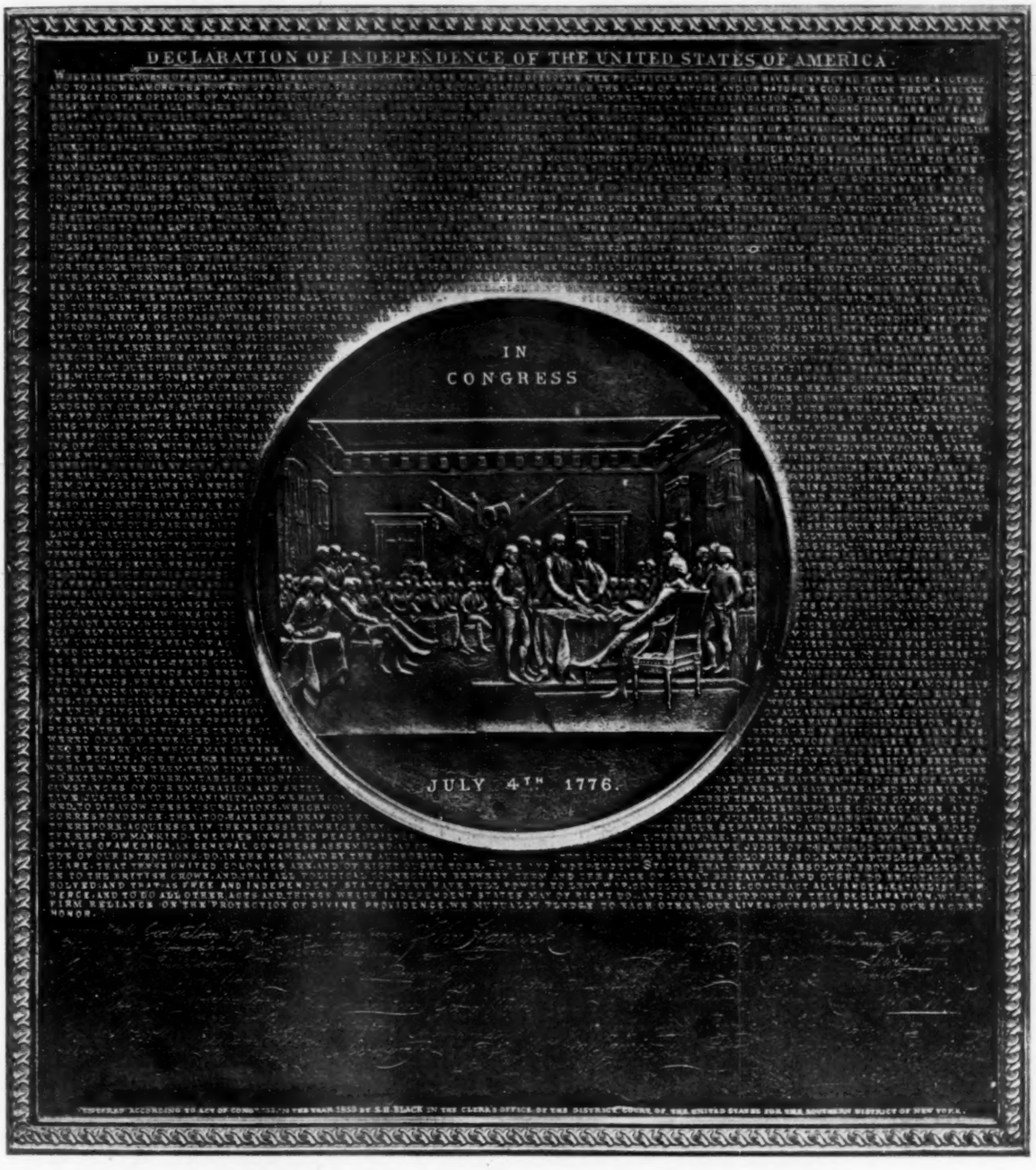
*Superintendent National Meter Company, Brooklyn, N. Y.

THE MANUFACTURE OF ELECTROTYPES FROM COPPER MOULDS.

By Joseph Dimes.

Electrotyping from wax and gutta percha moulds has become very common in the art of electrotyping, but there are very few who are making use of metal moulds. Where large quantities of plain work are made; that is, work with no undercut, the metal mould can be used to good advantage, as it is an everlasting mould and is very easily prepared for the bath. I have used metal moulds very successfully for both silver and copper electrotypes. The process is simple and is worked as follows:

The pattern is taken, or a number of different ones are taken, and after finishing (that is, polishing all plain parts), are soldered to a brass or copper plate. The plate is then cleaned to remove all soldering acid and dried thoroughly. Now take a solution of iodine (½ ounce of resublimate of iodine dissolved in one gallon of denatured alcohol) and flow this over the face of the pattern and allow to dry. This forms an oxidize or iodide of copper on the surface of the pattern; when thoroughly dry the pattern is black leaded with a stiff brush; the back and edges are now painted with wax as a stop-off, and a wire attached, which is done by



IMPRESSION OF THE DECLARATION OF INDEPENDENCE DEPOSITED ON A COPPER MOLD IN 4 HOURS.

drilling a hole in the plate the patterns are soldered to.

When the stopping-off has been properly done and the wire attached, the face of the pattern is washed off with clean water. The best way to do this is to lay the pattern on two pieces of wood across the wash tank and squirt the water from a hose on the face of the pattern. It is now hung in the acid copper solution, and if the solution is in good order the pattern will be covered at once with copper, and start to plate. The best solution I have ever used for this class of work is made as follows: Fill the tank intended for the solution to within eight inches of the top with good clean water, as free from lime as possible; dissolve chemically pure sulphate of copper in the water until it registers 16 degs. Baumé (this is done by suspending the sulphate of copper in bags at the top of the solution and stirring frequently), then add oil of vitriol until the hydrometer registers 18 degs. Baumé. Then take one pound of oxalic acid to every 100 gallons of solution, dissolve in as little water as possible and add to the solution; stir well and allow to stand until it settles—about five or six hours—when it is ready for use.

When the pattern is put into the solution it is started on one and one-half volts and allowed to run so for about four hours, then the voltage can be raised to two and one-half volts and run for thirty-six hours, when it can be removed from the solution. It is now washed and dried, and with an old dull knife the copper deposit or mould can be separated from the pattern. The mould can now be backed up with solder to stiffen it, cleaned as a piece of work for plating, dried and treated with iodine, then black leaded the same as the original pattern, stopping off the edge and back, the surface washed with water, put into the bath and allowed to plate, as before, for thirty-six hours, or until the required thickness is obtained. Upon removing the deposit from the mould you will have an exact reproduction of the original pattern; every line of the chaser's tool, no matter how fine, will show, and the plain parts will be clean and bright and only need to be rubbed off.

I have produced this work from metal moulds in large quantities in copper and silver, and found it to compare very favorably with sand moulding. After one has the mould it takes only a few minutes to prepare it. A mould 3 x 5 feet can be prepared and put into the bath in twenty minutes. This same mould 3 x 5 feet may have from 100 to 200 small patterns on it. Where this process can be used it reduces the cost of the output, as there is no fuel or crucibles to be counted on for melting, and all scrap metal can be used over.

The above cut shows a piece of work done by the above process. It is 6½ x 7¼ inches, was deposited in 4 hours and weighs 2¼ ounces. The back of the placque is just as smooth as the front.

THE COLORING AND STAINING OF METALS.

THE PRODUCTION OF BROWN AND BLACK TONES ON BRASS AND COPPER.

BY THOMAS HADDOW.

In the finishing of ornamental brass work, such as chandeliers and various kinds of metal goods, it is often necessary to produce certain artificial effects of color or tone to render the work attractive to the public eye. These effects are produced by several well-known means, but modifications are constantly sought for, with a view of giving variety to manufactured articles. From some experiments that I have tried and also from my experience in handling this class of work I am enabled to suggest one or two processes which may be found useful to persons engaged in the various branches of trade in which metal coloring and staining are necessary operations in the workshop.

By using a solution composed of

Sulphuret of potassium	2 ozs.
Barri sulphuret (pure)	4 ozs.
Liquid ammonia	8 ozs.
Water	25 gals.

a very pleasing brown finish can be obtained direct on brass. To produce the finish correctly the work must be sand-blasted, then washed thoroughly in the potash and cyanide dips and rinsed in clear cold water and at once immersed in the staining solution until it has a gray appearance, when it should be at once immersed in a solution consisting of the following:

Sulphuric acid	1 gal.
Water	25 gals.

which will set the color. Rinse thoroughly in clean, cold water, then in hot water and dry out in hot sawdust and brush with a tampico brush, revolving at a speed of 900 revolutions per minute. After the brushing have the work lacquered with a satin finish lacquer which will bring up the color.

Almost any shade of brown from a light brown to a black can be produced on copper or copper-plated articles, by using a hot solution of sulphuret of potassium, one-tenth of an ounce to one gallon of water. A very fine chocolate bronze color can be produced direct on brass articles by using a solution made up as follows:

Sulphate of copper	4 ozs.
Double nickel salts	4 ozs.
Chlorate of potash	4 ozs.
Water	1 gal.

Use the solution boiling hot and have the work polished, then clean thoroughly and immerse in the above solution until the desired shade of color is reached, when the article must be at once removed from the solution and rinsed thoroughly and dried in hot sawdust and lacquered. A black nickel solution can be used with good results on a large variety of metal goods and shows up very well where the high parts have a highly-polished finish and the low parts or background show a matt surface. To get the best results from a black nickel solution, care must be taken in regulating the current and the anode surface. The current should not be more than one-half volt and the anode surface should always be less than the cathode surface to get the best results.

BRASS SOLUTION.

For a brass solution that may be accepted as a standard for brass plating metal articles, the following is recommended:

Carbonate of Copper	2 ozs.
Carbonate of Zinc	1 oz.
Bi-sulphite of Soda	3 ozs.
Cyanide of Potassium	8 ozs.

Dissolve the carbonate of copper in cyanide by the usual way in a separate jar, also the carbonate of zinc. Add the copper to the main bath, and add zinc until the solution begins to plate a brass color or the desired shade is produced. To brighten the color add ammonia from time to time.

THE EQUIPMENT AND ARRANGEMENT OF MINTS IN ENGLAND

By "Fandorwall."

A mint is a place where money is coined by public authority. As to how such an institution first came into existence we have nothing to do with in this article. In England the Chancellor of the Exchequer for the time being is the master of the Royal Mint, but the actual administrator is the Deputy Master, a permanent officer. The melting, coining, and die department is styled the operation department, and is controlled by one superintendent. The two other chief officials of the mint are the chemist and assayer, and the chief clerk.

LAYOUT OF A MINT.

Fig. 1 is a block plan of a mint capable of turning out 450,000 finished coins in a day of eight working hours. The building is 372 ft. long x 144 ft. wide, with a yard (or open space) 36 ft. wide, extending the whole length of the building; thus the site contains 7,440 sq. yds.* The roof principals are all 48-ft. space, placed at intervals of 12 ft. There are three roofs, or ridges, running the whole length of the building, forming what is known as a M. & A. roof. The plan shows twenty distinct shops and rooms, all of which, with the exception of Nos. 6, 7, 8, 10, 11 and 14, are connected with a 20-ft. tramway. The general office (9) is entered at the end of the building at A, while the entrance for material and workmen is at the side B, No. 14 being the time office, and No. 7 the weighing machine house, containing a fine platform weighing machine, and the "steelyard" of the large machine outside for weighing fuel, etc.

*If any extension to the mint is anticipated, it would be wise to make the yard or open space 48 ft. wide.

All the machinery, including the rolling mill, will be electrically driven, thus concentrating the power department in a power house, No. 15, with a maximum output of 275 b. h. p. The current for lighting will also be generated here. This arrangement dispenses with long lengths of heavy driving shafts, main driving belt pulleys, heavy belting, and long lengths of steam piping. No. 16 is the boiler house, containing two Lancashire boilers, 30 x 8 ft., to work at 150 lbs. per sq. in.; economizing feed pump, chimney stack and hot water arrangement for warming the mint.

GENERAL EQUIPMENT.

The gold and silver is stored in the general office (9) in the strong room (10), where it is weighed out and then conveyed over the tramway through b to the melting shop (1). The copper on arrival at the mint, together with the tin and zinc for making the bronze coin is weighed in 17 and then conveyed to the copper stores a, which is convenient to the melting shop (1). In the melting shop are furnaces for thirty pots or crucibles of 140 lbs. capacity; there are three benches of furnaces, each having holes for five pots, arranged down each side of the shop. These furnaces are of the ordinary type used for melting brass, and, of course, are fired with coke, which is conveniently stored in b. Each range of furnaces is served with two light traveling cranes, each capable of lifting 5 cwts. These cranes are worked by hand and are carried on suitable rails supported by brackets on the columns down the center of the shop, and by brackets in the walls down each side of the shop. These thirty furnaces, with 140-lb. pots, are capable of

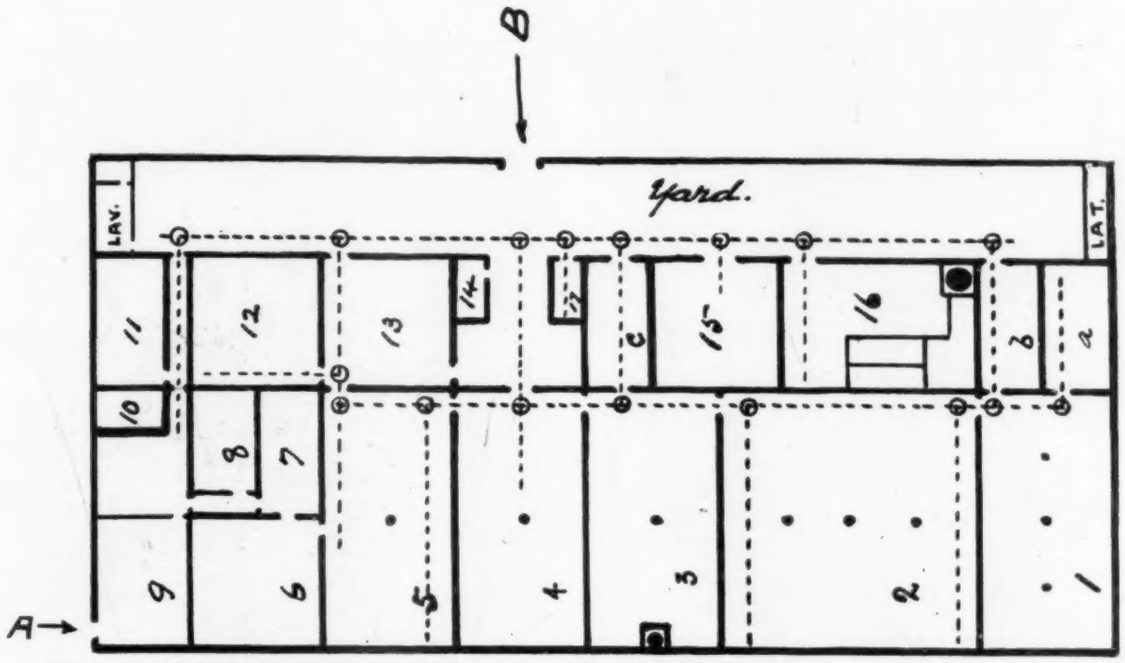


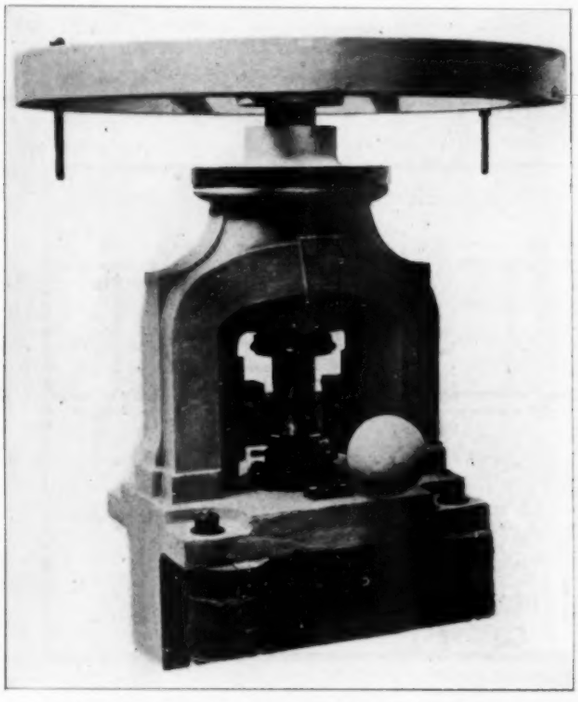
FIG. 1. BLOCK PLAN OF MINT. CAPACITY, 450,000 COINS PER DAY OF 8 HOURS. SCALE, 1/64" = 1' 0".

1. Melting Shop.
   a. Copper Store.
   b. Coke Store.
2. Rolling Mill.
3. Annealing.
   c. Coke, etc., Store.
4. Pickling.
5. Coining.
6. Examining and Weighing.
7. Making Up.
8. Finished Coin.
9. General Office.
10. Strong Room.
11. Assaying.
12. Die Shop.
13. Mechanics' Shop.
14. Time Office.
15. Power House.
16. Boilers.
..... Tramways.
17. Weighing Machine.

melting over eight tons of metal per day. The melting shop would work continuously throughout the day, say for twelve hours, and to get through and cast this weight of metal about eighteen men would be required. This weight of metal, of course, has reference to bronze, and it is hardly necessary to state that this weight of gold or silver would never be melted in any one day.

MOLDS AND INGOTS.

The molds in which the ingots or bars are cast are fixed in a carriage moving on rails parallel with the rails upon which the cranes travel. The ingot mold carriage moves under a frame for holding and tilting the crucible when pouring the metal into the molds. This tilting arrangement is worked by hand through gearing, and as each mold is filled the mold carriage is moved so as to bring the next one under the crucible, or pot. This frame is really a casting or pouring machine, and without it the number of men required



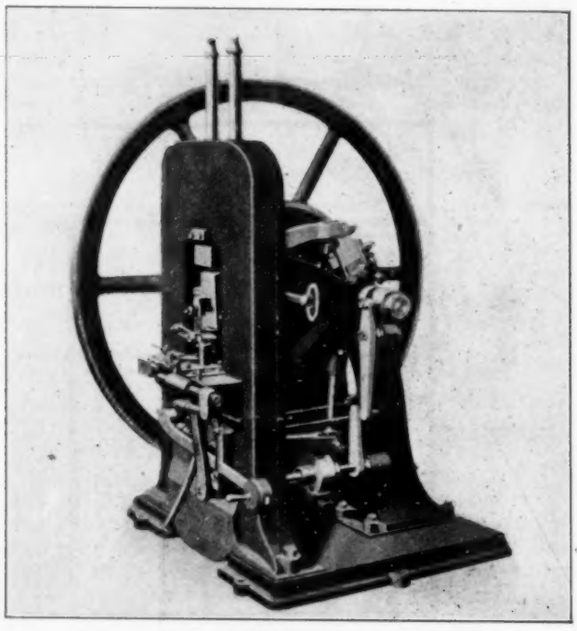
DIE MULTIPLYING PRESS FOR REPRODUCING WORKING DIES FROM THE PUNCHES.

would be increased. Two of these machines should be in use—one for each side of the melting shop, i. e., one for each fifteen furnaces. The best shape of the ingot has been found, from experience, to be of a flat section, as the coins are made from blanks punched out of flat strip. It may just be mentioned here that cutting discs off the end of round bars has been tried for the purpose of preventing the making of scrap, such as is made when punching the blanks out of flat strips, but without success.

The dimensions of the ingots vary from 12 ins. long x 1¾ ins. to 25/8 ins. wide x 3/8 in. thick, up to 18 ins. x 3½ ins. x 3/8 in. for different metals, as well as for different coins. The ingot molds were at one time made and used without any machining having been done on them at all, thus giving a rough ingot, causing excessive wear upon the rolls and an inferior surface on the finished strip. It is of great importance that the molds should have the inside surface machined all over and well polished; this makes an expensive mold, but the extra cost is more than balanced by the reduced upkeep of rolls and dies. Forty to sixty molds are placed on the mold carriage, and all are bolted tightly together with four long bolts. The molds should be made in such a manner that as soon as the four bolts are slackened the ingots will be free to strike out when the nest of molds is canted. All that is required to be done to "make ready" again, is to tighten up the four bolts. The casting, clearing of the molds of ingots, and "making ready" again only occupies a few minutes, the ingots being only 3/8 in. thick, cool very rapidly.

MIXING, ALLOYING AND ROLLING.

The alloying of the metal is important, and is fixed by the powers charged with this responsibility. In England gold coins are 11/12 fine gold and 1/12 alloy; silver coins are 37/40 fine silver and 3/40 alloy, and bronze coins are 95/100 copper, 4/100 tin and 1/100 zinc. The chemist or assayer, whose laboratory is in

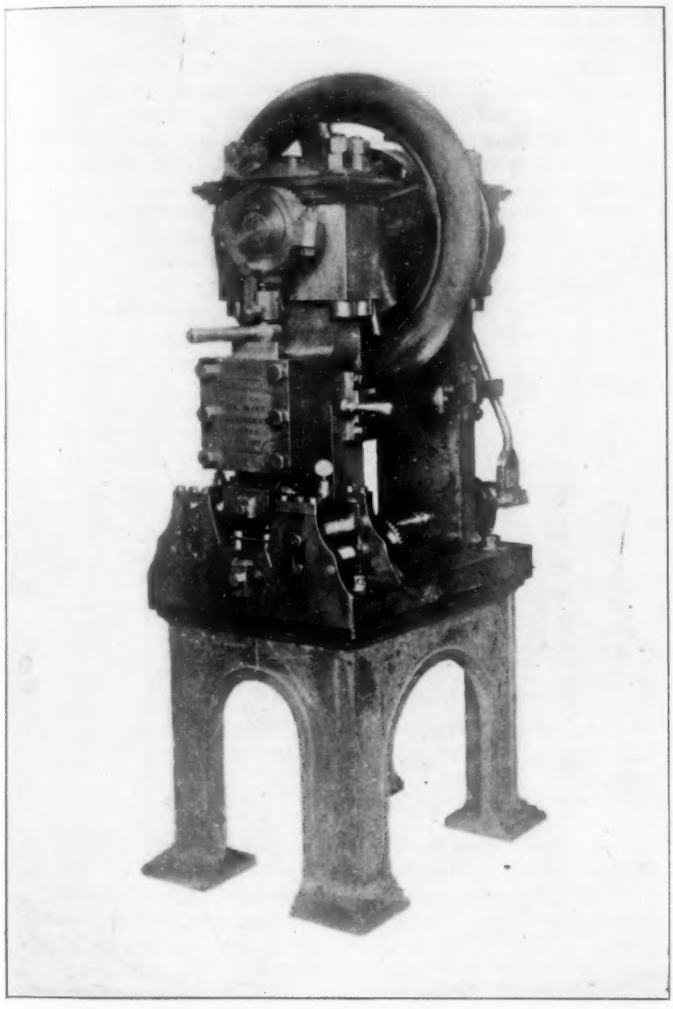


EMBOSSING PRESS WITH DIAL FEED.

No. 11 on the block plan, should make a test of each melting, i. e., test one ingot from each pot to ascertain whether the mixture of metal is correct; the blanks should also be assayed before the marking operation. This repeated testing has reference only to the gold and silver coins, the bronze coins do not demand such frequent assaying.

When it has been ascertained that the ingots or bars are correctly alloyed, they are sent into the rolling mill (No. 2 on the plan), which contains four double pairs of rolling mills with rolls 10 ins. and 12 ins. in diameter. Alongside the wall next to No. 1 there are one strip shearing machine, three ingot shearing machines and eight rotary files; these rotary files are mounted on a bench. The rolling mill is furnished with a hand trying press and trying scales. These machines would be driven from an overhead shaft driven by a separate motor. The description of the plant is now for bronze coins, except where specially mentioned, there being very little difference in the operations on gold and silver.

The first operation on the ingots is to shear off the imperfect ends and then they are taken to the rotary files, which remove all fins and any other roughness upon the surface of the ingot. The ingots are now ready for rolling, which is done cold. The "first passes" through the rolls is called "breaking down," and when the greatest reduction in thickness takes place; after breaking down, the strip is cut into lengths four to five feet long on the strip shears, suitable for the annealing furnace, placed upon a cast iron carriage and run into the furnace, the temperature of which is raised to 530 degs. C. The strips must remain at this heat for one to two hours, according to



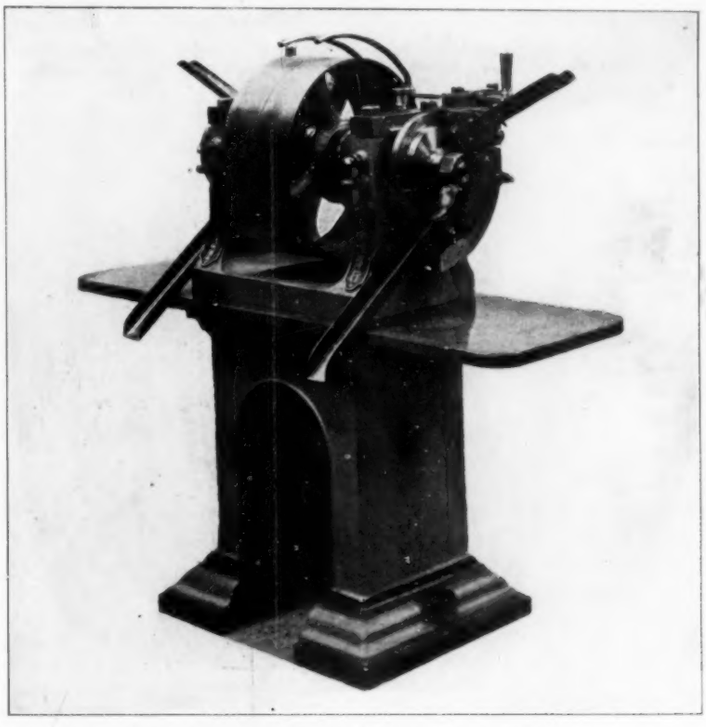
AUTOMATIC BLANK CUTTING MACHINE USED IN ROYAL MINT, LONDON.

the condition of the metal (experience must decide the time the strips should remain in the furnace) and afterwards withdrawn and quenched in cold water. The annealing furnaces are in shop No. 3 on plan, which contains four double furnaces, coke fired, with quenching troughs conveniently placed to receive the strip or blanks. The furnaces are connected to the chimney shown, with an underground flue.

The strips oxidize during the annealing, and to remove the oxide the strips must be "pickled" in dilute acid for a short time and then scrubbed on benches, well washed in plain water and dried off in non-resinous sawdust.* The strips are now ready for the final rolling, and are returned to the rolling mill for this purpose, on small trucks running on the tramway. The finishing rolls are highly polished so as to give a dead smooth surface on the finished strip. The correct thickness of the strip is obtained by gauging and finally to check the gauging, a number of blanks are punched out in the try press and weighed in the try scales. The final reduction of thickness of the gold and silver strip is sometimes done by drawing through dies; the drawbenches are placed in No. 2 alongside the wall to No. 3 and are driven by a separate motor.

CUTTING THE PLANCHETTES.

The strip is now ready for blanking, and it is placed upon trucks made specially high for the purpose of preventing the strip trailing on the floor, and conveyed over the tramway to the coining shop, No. 5 on plan. The coining shop contains two blank cutting machines, one strip shearing machine to cut up the scrap



EDGE ROLLING OR MARKING MACHINE FOR THICKENING THE EDGES OF BLANKS BEFORE STRIKING.

after the blanking operation, two marking machines, and twelve coining presses. The coining presses are placed in the center of the shop, six on each side the column parallel to the longer walls. The shafting for driving these twelve coining machines is carried by six rolled joists bolted to the roof principals, all on one side of the column, and on the opposite are two more rolled joists to carry the motor. All the other machines are placed alongside the walls next to No. 4, and the shafting for driving them is supported on wall brackets; the motor is on the floor.

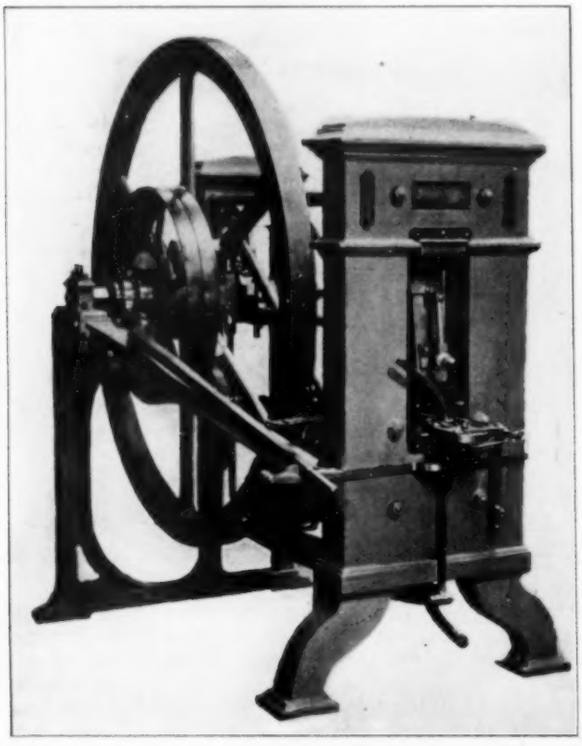
The first operation on the finished strip is cutting out the blanks. The blank cutting machines are fitted with multiple punches and dies to punch out two, three and sometimes four blanks at each stroke. The num-

*This operation is performed in Number 4 Shop, which will be referred to again.

ber of blanks cut out at each stroke is governed by the diameter and thickness of the coin, the width of the strip being made to suit. A machine designed to cut out four farthings at each stroke, would cut out three halfpennies and two pennies per stroke. The total circumference of four farthings is about 10¼ ins.; the total circumference of three halfpennies is about 9½ ins.; the total circumference of two pennies is about 7½ ins., but of three pennies it is 11¼ ins., one inch more than the four farthings and a thicker coin also. It would not be wise to put this apparently small amount of extra work upon the machine and punch three pennies at one stroke instead of two pennies, as its efficient life would be considerably shortened; the machine would certainly punch a few penny blanks at three per stroke without doing damage, but this is not to be compared with continuous working at 135 to 145 strokes per minute, under these actual working conditions the extra inch and extra thickness becomes a very serious matter.

MARKING AND ANNEALING THE BLANKS

The next operation on the blanks is called "marking." The edge of the blank as it comes from the



AUTOMATIC LEVER COINING PRESS AS USED IN ROYAL MINT, LONDON.

blank cutting machine is comparatively rough, not quite square with the face and one corner slightly rounded. These defects are removed in the marking operation, which is done on a machine which not only smoothes the edge and makes it square with the face, but produces the raised rim round the blank on each side in the following simple manner: The blanks are fed into this machine down a chute, and they come into contact with a grooved disc revolving at a high speed, which draws them down a corresponding groove in a stationary die, which can be adjusted to any diameter of blank.

Considerable work has been put into the metal since it was last annealed; it has been rolled to the finished thickness, it has been punched, and the edge has been rolled. This work has made the blanks much harder, especially at the circumference, too hard for the coining which is the next operation. There is, therefore, an intermediate operation, that of annealing, between marking and coining, which will give an even temper all through the blank and make it soft enough for the coining machines. In all annealing it is very important to exclude the air from the articles being annealed, and especially so in the case of strip and blanks for coins. The blanks are placed in metal dishes, lightly packed with charcoal dust and the dish covers heated with clay or sand to exclude the air. These dishes are placed upon the carriage and run into the furnaces as was done with the strip, where they must remain for two hours at a temperature of 530 degs. C., when they are withdrawn the covers are removed and the blanks thrown into the quenching tanks. The quenching tanks are provided with metal baskets to receive the blanks so that when they are thoroughly quenched they may be all lifted out together.

There will be very little oxide on the surface of the blanks, but they will be discolored and stained, all of which must be removed; for this purpose the blanks are taken to the pickling shop, No. 4 on the plan, in which are the pickling tanks containing dilute acid of various strengths, clean water tanks, scouring benches, and drying drums. There are five drying drums, which are driven from a shaft carried on wall brackets and driven from a small motor which is fixed on a bracket secured to the wall. The blanks are placed in metal baskets and lowered into a tank containing very dilute acid, where they will remain for a little time—experience will say how long. After pickling, the blanks must be well and thoroughly washed in cold water which is continually being renewed, to remove all trace of acid. If the blanks are quite free from stains and oxide when taken out of the cold water tanks, they are placed in the drying drums with boxwood sawdust, which is the best, but any other non-resinous sawdust will do. The blanks should not remain in the drying drums too long, otherwise the continual rolling in the drums will wear them. The cleaned blanks are now returned to the coining shop to be coined.

COINING THE CURRENCY.

The coining presses are machines of great strength and stability, made of the very best material and workmanship. All parts requiring it are so designed that the finest adjustments can be made. The top and bottom dies are fixed perfectly square and parallel with each other, and their sockets or seats are so arranged that, should either of the dies shrink unevenly, as they sometimes do, through continued working, they can be adjusted to meet this contingency. The blanks are automatically fed to the dies through a chute, and are coined at the rate of 80 to 90 coins per minute. Although the machine is automatic in all its actions and is so arranged that it is impossible for the dies to clash, should there be no blanks in the machine, the attendant has to be very watchful, so as to see that nothing goes wrong, and he must continually examine the coins to see that the impression is perfect, and that no cracks have developed in the dies, which sometimes happens.

THE OVERLOOKING MACHINE.

The coins are now passed on the examining and weighing room (No. 6), in which is an overlooking ma-

chine, and for the gold and silver coins,an automatic weighing machine, which sorts out the light and heavy coins. The overlooking machine is so designed that the coins pass before the inspector twice, so that he may see both sides, and it then delivers the coins in rolls at the end of the machine. The inspector picks out all coins which appear to be defective as they pass before him, for a subsequent inspection; the coins which are delivered at the end of the machine are passed on to the automatic weighing machine in the case of gold and silver coins, and to the making up room (No. 7) in the case of bronze coins. The gold and silver coins go to the making up room from the weighing machine. When the coins have been made up they are stored in room No. 8 until they are called for.

(To be continued.)

COPPER-NICKEL ALLOYS*

THE INFLUENCE EXERTED ON THE CHARACTER OF ALLOYS BY THE DEGREE OF PURITY OF THEIR CONSTITUENT METALS.

By A. H. HIORNS.†

(Concluded from August.)

ALLOYS MADE FOR INVESTIGATION.

For the purposes of this investigation a series of alloys of copper and nickel were made in a clay crucible with the lid luted on. The object being to ascertain the exact relation between these metals. The metals were placed together in the crucible in the cold, as it was unnecessary to melt one before the other in this case, both metals being non-volatile and possessing high melting points. Carbon was rigorously excluded. Two sets of alloys were made, one being suddenly quenched and the other allowed to cool slowly. The ingredients were carefully weighed before melting and the alloy weighed after melting and cooling so as to ascertain if any furnace loss occurred. In an experiment made with electro-nickel, melted in contact with carbon for an hour and allowed to cool slowly in the furnace, the amount of free carbon was found to be nearly 2 per cent. On examining this specimen under the microscope after polishing and etching, it was found to contain numerous small flakes of graphite (Fig. 1). A series of alloys of copper and nickel were made with commercial nickel, and their micro-structure examined. It was found that the structures were different from similar alloys made with pure nickel. In some of these alloys flakes of graphite were present. Fig. 2 contains 95 per cent. nickel and shows the effect of strongly heating and slow cooling. In consequence of the interfering character of the impurities in ordinary nickel it was considered necessary to use pure nickel. The alloys were made in a covered clay crucible in the absence of carbon and the freezing points determined as well as the micro-structure. Each alloy was allowed to cool very slowly so as to allow any separation to occur and to bring the metals into a state of equlibrium. The freezing points were determined by means of a platinum and platinum-rhodium couple.

It may be stated first that there are no chemical compounds of copper and nickel, neither is there any eutectic mixture. The metals unite in all proportions without any separation on cooling. Hence it is inferred that the metals form solid solutions or mixed crystals in all proportions. The freezing point is practically a continuous line. There is no angle of intersection of two curves, but the points on the curve correspond exactly to saturated solutions. The freezing point curve of copper-nickel alloys has been studied by Gautier, who marks a transition point in the alloy with 50 per cent. nickel. He evidently used impure metals, otherwise such a point could not have existed. Also the temperatures on the greater part of his curve are too high. He takes the freezing point of copper as 1,050 degrees C., and that of nickel 1,440 degrees C. In the present experiments electrolytic copper and electrolytic nickel were used.

FIG. 1. COMMERCIAL NICKEL ALLOY SHOWING FLAKES OF GRAPHITE.

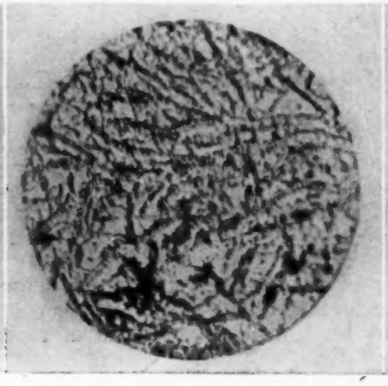


FIG. 2. 95 PER CENT. NICKEL ALLOY SHOWING EFFECT OF STRONG HEATING AND SLOW COOLING.

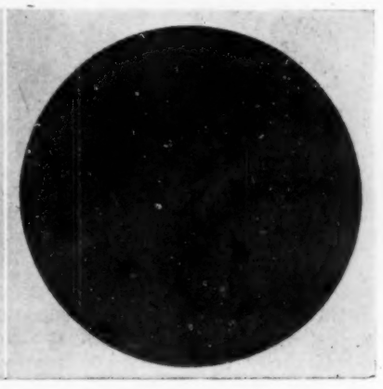


FIG. 5. 80 PER CENT. COPPER AND 20 PER CENT. NICKEL ALLOY SHOWING SOLID SOLUTION.

Leon Guillet has also studied some of the alloys of copper and nickel. He states that the micro-structure of the alloys with less than 50 per cent. nickel shows two solutions but he was not able to define the degrees of concentration of these solutions. A prolonged baking produced uniformity of the solution, when the structure assumed the forms of polygons, therefore copper and nickel dissolve in each other in all proportions. He has also determined the mechanical properties of some of the alloys, as shown in table V.

Tensile strength and elastic limit are in tons per square inch. On comparing the results we see the effect of work on the elastic limit with alloys lowest in nickel. In alloys up to 15 per cent. of nickel, after annealing, the

*Paper read before the Birmingham Metallurgical Society.
†Professor of Metallurgy, Birmingham Technical School.

elastic limit is exceptionally low. In rolled specimens the elastic limit reaches 10 and in the higher nickel alloys 19 tons per square inch. Under the same treatment the difference of breaking stress is not so marked.

TABLE V.

State.	Copper.	Tensile Strength.	Elastic Limit.	Elongation.	Reduction of area.	Hardness.	Color.
Worked	94.9	12.4	10.4	27	51.8	63	red
"	90.7	12.2	10.1	14	46.8	61	pale red
"	85.7	19.4	19.3	2	11.0	73	yellow
"	80.6	20.1	20.2	3	10.2	73	white
"	70.5	20	19.1	6	19	88	grey
Annealed at 750 C.	94.9	10.4	0.21	44	49.8	53	red
" "	90.7	10.1	0.17	40	57.1	53	pale red
" "	85.7	9.5	0.14	19	25.2	57	yellow
" "	80.6	15	12.4	15	16.4	60	white
" "	73.9	15.4	12.1	9	16.4	65	grey
" "	70.5	16	14	9	18.8	71	grey

Guillet's figures as regards mechanical properties do not agree with the general experience with commercial alloys in this country, as shown in the following table:

TABLE VI.

Copper.	Nickel.	Material.	Ten. Str. tons per sq. in.	Elongation, per cent.	Guillet's results. Tensile strength.	Elongation, per cent.
98	2	Tubes, soft	17.5	44		
98	2	Tubes, hard	28.25	5.5		
95	5	Rolled, soft	17.5	50	10.6	44
95	5	Rolled, hard.....	30	4	12.6	27
80	20	Rolled, soft	21	35	15	15
80	20	Rolled, hard	40	4	20.2	3
75	25	Rolled, soft	27	31		
80	20	Rolled, soft	25	32	Very strong, due to iron.	
80	20	Rolled, hard	24	16	Brittle, due to carbon.	

After these experiments had been made the author discovered that copper-nickel alloys had been investigated by Guertler & Tamman. It was satisfactory to know that these authorities arrived at similar conclusions to those of the author with regard to the freezing point, but had extended the research to finding the limit of magnetization at definite temperatures varying with the composition of the alloys. Guertler & Tamman (Zeit. Vol. 51-52) used nickel containing 0.47 per cent. of iron and 1.86 per cent. cobalt and a trace of copper. The copper was pure electrolytic. Their curves in Fig. 3

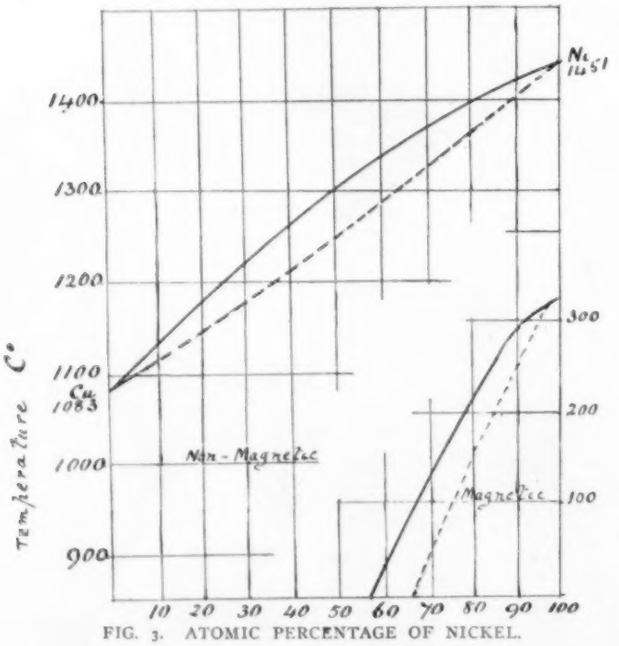


FIG. 3. ATOMIC PERCENTAGE OF NICKEL.

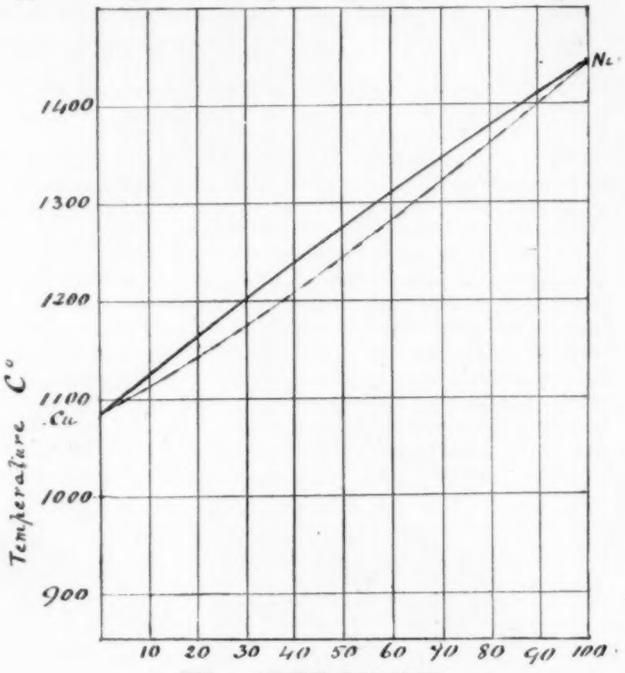


FIG. 4. NICKEL PER CENT.

show the beginning and interval of crystallization, as shown by the dark and dotted lines. The field of non-magnetic mixed crystals is shown below and the curve shows the range of magnetism in the mixed crystals. The melting point of copper is taken as 1,083 degrees C. and that of nickel as 1,451 degrees C.

Nickel has at 320 degrees C. a change point, above which it ceases to possess magnetic permeability. The presence of copper lowers this point.

TABLE VII.

Nickel, per cent.	Loss of Magnetism on heating.	Return of Magnetism on cooling.	Average.
89.1	315	280	295
78.6	215	190	205
68.2	125	105	115
57.9	not appreciable.	about 30?	30?

The alloy with 50 per cent. nickel is only feebly magnetic at the ordinary temperature. The curve shows the transition temperature for magnetism of the alloy containing magnetic mixed crystals, and also shows the division into magnetic and non-magnetic mixed crystals. The alloys with 100-25 per cent. nickel have the color of nickel, while the alloys with 20 per cent. and less of nickel are colored by copper.

Fig. 4 shows the curves of freezing points obtained by the author which will be seen to approximate fairly closely to those of Guertler & Tamman.

SOLID SOLUTIONS OF NICKEL IN COPPER AND THEIR PROPERTIES.

Nickel appears to dissolve in copper up to a certain percentage, forming homogeneous solid solutions. On the other hand, taking nickel as the solvent, copper dis-

solves in nickel forming homogeneous solid solutions also up to a certain limit. At all intermediate proportions between these limits we have two distinct solutions, one containing the limiting proportion of nickel and the other the limiting proportion of copper. These two solutions therefore consist of a saturated solution of nickel in copper and a saturated solution of copper in nickel, the relative amounts of the two solutions depending on the composition of the alloy.

The above remarks apply to copper-nickel alloys which have been very slowly cooled but in quickly cooled samples the equilibrium between the conjugate solutions has not been reached and the solid solutions are in a more or less unstable state and the relative stability of that state at the ordinary temperature will determine their industrial value.

A convenient way of revealing the two solutions is by means of heat tinting. It was found that etching liquids in several cases gave no definite results but by heat tinting the two solutions were rendered evident owing to the different degrees of oxidisability and the different colors thus obtained. The parts which contain more copper oxidise with greater rapidity than those which contain more nickel. On any one grain or mass the oxidation commences at the outside and travels towards the center.

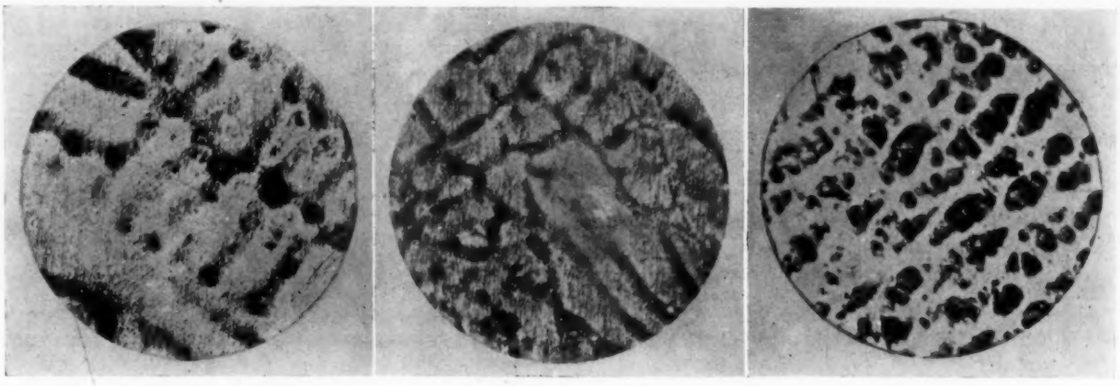


FIG. 6. REPRESENTS 60 PER CENT. NICKEL ALLOY SLOWLY COOLED. FIG. 7. SHOWING 50 PER CENT. NICKEL ALLOY SLOWLY COOLED. FIG. 8. SHOWING 20 PER CENT. NICKEL ALLOY QUICKLY COOLED.

There are several kinds of solid solutions:

1. In which one metal in an alloy, on crystallising, retains a portion of the other homogeneously diffused throughout its whole crystalline mass.
2. In which, during crystallisation, the central portions of the crystals contain less of the dissolved metal than their external boundaries.
3. In which the metals form a definite chemical compound, a portion of which is retained in solid solution in the excess of the metal or metals.
4. In which the non-metallic elements form definite chemical compounds with a portion of the dissolved metal and remain in solid solution.

Copper-nickel alloys are of the first type and may consist of one or two solid solutions, but the degree of concentration of either of them could not be determined. One fact, however, is certain. All the alloys with excess of nickel are magnetic and those with excess of copper are non-magnetic. This may afford an indication of their composition, but further proof will be required before they can be positively stated. Nickel, like iron, is a magnetic metal, and in a similar way ceases to retain its magnetic properties on reaching a certain temperature, but on cooling below that temperature the magnetic property is restored. The same is found with all copper-nickel alloys containing 60 per cent. of nickel and upwards and those containing less than 50 per cent. of nickel are non-magnetic. The magnetic alloy may be termed alpha and the non-magnetic beta. Now whether one of the solid solutions is magnetic and the other non-magnetic in all the alloys I cannot say, but it seems reasonable to suppose that such is the case. But if the beta alloy is simply mixed with the alpha alloy, then the magnetic condition should be evident, even when the beta alloy is in excess, but such is not the case, therefore the beta alloy must in some way unknown have the power of neutralising the magnetic properties of the alpha alloy. On the other hand, the magnetic properties of the alpha alloy cannot be due to free nickel, otherwise an indication would be afforded by the freezing point curve. It is possible that nickel might form an isomorphous mixture with one of the solid solutions and therefore remain undetected in the micro-sections.

Incidentally it may be remarked that copper-nickel alloys have a great tendency to develop blow-holes on casting, due to the presence of occluded gases. This is another indication of the absence of a chemical compound, since the presence of a compound in an alloy seems to have the influence of preventing blow-holes and closing the grain of the alloy. A good example of this is seen in phosphor bronze, arsenical copper and aluminum in iron. Of course these remarks only apply to pure alloys of copper and nickel.

The absence of a eutectic mixture is proved by the freezing point curve which forms approximately a straight line. These metals, therefore, can form an unbroken series of mixed crystals. The melting point is raised continuously by the addition of nickel, so there is no transition point as stated by Gautier. An indication of the existence of a solid solution is shown in the alloy with 20 per cent. nickel and 80 per cent. copper very slowly cooled. Here the thin boundary lines of large polygons are clearly seen such as is usual in a pure metal.

The general structure of alloys with less than 50 per cent. of nickel is shown in Fig. 9. These alloys were allowed to cool down slowly in the furnace. The same structure is observed in the alloy with 50 per cent. of nickel (Fig. 7). If alloys with excess of nickel are allowed to cool very slowy, as pointed out by Guertler and Tamman, they form large polygons and the whole tends to become homogeneous. Fig. 8 contains 20 per cent. nickel quickly cooled. Fig. 6 represents a 60 per cent. nickel alloy slowly cooled.

With respect to the magnetic properties of copper-nickel alloys, it was found that all alloys with upwards of 60 per cent. nickel were attracted by a magnet. The 50 per cent. alloy just shows a faint trace of magnetism, but so small as to be hardly perceptible. The method of testing was to weigh the alloy very accurately on a

chemical balance, then to place the pole of the magnet just under the scale pan containing the alloy and weigh again. In the magnetic series the pull of the magnet on the alloy caused it to weigh more than when the magnet was absent. In the case of the non-magnetic alloys, the presence of the magnet made no difference in the weighings. This appeared to be the most delicate means of

FIG. 9. GENERAL STRUCTURE OF ALLOYS WITH LESS THAN 50 PER CENT. NICKEL.

determining the magnetic properties the author was acquainted with.

SUMMARY.

1. In investigating the influence of nickel on copper in copper-nickel alloys, the metals employed must be practically pure, since foreign elements in an alloy tend to alter the structure, and this may vary with the rate of cooling.

2. Commercial nickel is often very impure, containing carbon, sulphur, copper, arsenic and silicon. The carbon generally assumes the graphitic form. The composition of various samples of commercial nickel is given in tables I-IV.

3. The alloys were made in a clay crucible, the nickel and copper being mixed and melted together, carbon being excluded. Sections of commercial nickel and copper-nickel variously treated, were made and the micro-structure determined.

4. The alloys for investigation were made with electro-nickel and electro-copper and the micro-structure obtained of samples slowly and quickly cooled.

5. The freezing point curve was determined by means of a thermo-couple. It was found that there were no chemical compounds nor eutectic mixtures. The metals unite in all proportions without any separation on cooling. Hence it is inferred that the metals form a series of solid solutions the degree of concentration of which could not be determined.

6. The mechanical properties of certain alloys is given by Guillet on Table 5, which shows the extraordinary effect of work on the elastic limit of alloys with less than 31 per cent. of nickel; while after annealing, the elastic limit is exceptionally low. When 15 per cent. of nickel is exceeded, the tenacity is greatly increased but the elongation and reduction of area are reduced and the hardness increased.

7. Alloys with more than 50 per cent, nickel are magnetic and those with less than 50 per cent. nickel are non-magnetic. In the magnetic alloys the magnetic property ceases at certain critical temperatures for the different alloys. This temperature is lower the greater the percentage of copper as shown by the curve of Guertler and Tamman.

8. The magnetic alloys, when slowly cooled, consist of large polygons which are composed of smaller ones. These smaller ones appear to be absorbed into the larger ones by long continued heating until the whole mass becomes homogeneous. This structure is confined to the magnetic alloys with over 60 per cent. of nickel. The non-magnetic alloys with less than 50 per cent. nickel have a structure made up of rows of elongated polygons at right angles to the longitudinal axis.

Copper-nickel alloys appear for the most part to consist of two solid solutions, one of which is magnetic and termed "alpha," while the non-magnetic solution if termed "beta." The magnetic properties cease when the nickel is present in less proportion than 50 per cent.

PLATERS' WRINKLES

SOME HELPFUL HINTS FOR PLATERS, SUPPLEMENTAL TO THOSE PUBLISHED DURING THE PAST THREE YEARS.

BY CHARLES H. PROCTOR.

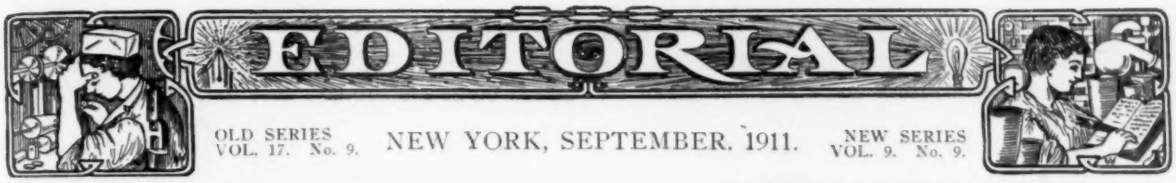
NICKEL SOLUTIONS.

The difference in temperature between summer and winter has a very decided effect upon nickel solutions. A bath may work very well all through the summer and fall, but as cold weather approaches the work does not come from the bath satisfactorily, oftentimes dark or grayish, and in some cases peeling results. This is due to the solution becoming more concentrated on account of the lower temperature. The solution oftentimes deposits crystals on the anodes or tanks.

If you have live or exhaust steam this trouble can be very easily overcome in the following manner: Procure a lead pipe with not less than a half-inch aperture, connect this with your regular steam pipes with valve connections. Have the pipe sufficiently long so that it can be immersed in the bottom of the tank and come up on the opposite side and then on the outside of the tank so that the condensed steam can run into a pail or other receptacle. Have a valve connection on the outlet also, so that the steam can be controlled. In very cold weather if the steam is allowed to pass through the pipe for fifteen minutes the temperature of the solution will be raised to the normal (70 degrees), thus overcoming the difficulties noted.

In plating novelty work a small addition of gelatine or transparent white glue will give an exceedingly bright lustre to the nickel deposit, providing the deposit is not too heavy.

A good method to pursue in using up parts of old nickel anodes is as follows: Procure an iron rod of not less than one-quarter inch diameter, bend one end in the form of a hook, at the other end cut a thread so that a washer and nut can be used, drill holes in the pieces of anodes, and then place them on the iron rod. When sufficient has been placed upon the rod, put the washer and nut in place; coat them and also the part of the rod exposed to the action of the solution with a little asphaltum varnish, which will prevent corrosion. This method does not expose much surface, but it is a good way to use up old pieces of anodes that would have to be sold for less than half price.



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THE ELECTRO-PLATERS' REVIEW, COPPER AND BRASS

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CONTENTS

INSTITUTE OF METALS

Some time ago we had cause to complain that there was a distinct danger of the Institute of Metals developing into a purely academic institution. Its founders—and we ourselves—had hoped that it would escape both the Scylla of abstruse scientific jargon and the Charybdis of thoughtless, ill-conceived, and ill-presented investigations. With some advance information in front of us of the papers for the forthcoming Newcastle-on-Tyne meeting of the Institute—the fourth annual autumn meeting, by the way—we are able to say without a doubt that the faith of the founders was not in vain. There is every indication that the numerous papers to be presented at Newcastle on September 20 and 21 will prove to be of the utmost value to the several branches of the non-ferrous metal trades.

The council of the Institute are to be congratulated on their success in having insisted on the various authors keeping well in view, in their various communications, the practical aspects of the subjects which form the bases of their investigations. As we have said on previous occasions, we realize that it is an exteremely difficult matter for the council of a young institute to break down the barriers of secrecy that surround so many branches of the metal trades. It is easy for the critic to say, "you must give us more practical papers." But the council cannot make bricks without straw. The "breaking down" process will be a gradual one, but it will be facilitated enormously if leading members of the Institute, such as the president himself, Sir Gerard A. Muntz, Bart., would consent to read a paper on some works subject before the Institute. We understand, unofficially, that Sir Gerard has expressed his willingness thus to "come out of his shell" (to use one of his own expressive phrases) as soon as his relinquishment of his presidential duties will permit, so that members may be on the qui vive for a specially interesting paper during next session.

Only on one previous occasion has a member of council favored the Institute with the benefit of his knowledge and experience, this being on the occasion of the Birmingham meeting in November, 1908, when Mr. J. T. Milton, the chief engineer surveyor of Lloyds Register of British and Foreign Shipping, gave his paper—now almost a classic dissertation on the subject—"On Some Points of Interest Concerning Copper and Copper Alloys." That paper was a model of what such papers should be. We are led to believe that it will be found when the members receive their advance copies of the paper that is now in course of preparation by another member of council, Mr. George Hughes,

the chief mechanical engineer of the Lancashire and Yorkshire Railway Company, entitled "Non-Ferrous Metals in Railway Work," that Mr. Hughes has followed closely in Mr. Milton's steps and has given us a paper crammed with practical information and rich in useful suggestion. The subject is an excellent one, as practically all the non-ferrous metals (except the rare elements) are employed in one form or another in the running of a great railway. The composition of the several alloys, of which Mr. Hughes will give analyses, should give rise to a most interesting discussion in which the "practical man" should feel quite at home.

In view of the work now being undertaken by the Corrosion Committee, a statement with regard to which will be made by the president at Newcastle on September 20, the paper to be read by Mr. Paul T. Brühl, M. Sc., "On the Corrosion of Brass with Special Reference to Condenser Tubes" will be received with especial interest. For many months past Mr. Brühl has been closely investigating this subject in a very practical way. He has obtained quantities of seaweed from various parts of our coasts, also different kinds of ashes, in order to see whether, and if so, to what extent, the corrosion of condenser tubes may be influenced by the presence of foreign substances of this character.

An investigation into the causes of the failure of a brazed joint forms the basis of a suggestive paper contributed by a Newcastle member of the Institute, Professor Henry Louis, M. A. D. Sc. The failure occurred in the steampipe of the steamship Lord Cromer last year, and resulted in a fatal explosion. The pipe was of copper, 5½ inches in internal diameter, and it was found that the explosion was due to the opening up of the longitudinal brazed joint of the pipe for a length of 3 ft. 6 ins. The braze was found to be badly corroded, due to the presence of lead which the sea water readily attacked. Professor Louis also states that the part played by the physical structure of the brazing material in affording an opening to the corroding liquids was very marked, and this is shown in an instructive series of photographs. "The Mechanical Properties of Hard-drawn Copper" is the title of a paper to be read by Mr. D. R. Pye, B. A., who discusses the post office specification for this very important material. Mr. Pye's views will be much discussed both by the wire-drawers themselves and by the electrical engineers who are called upon to utilize the worked metal. The latter will also be interested in an appendix to the paper dealing with the effect of hard drawing upon the electrical properties of copper, and in another paper, "The Electric Conductivity of Alloys," by Dr. W. Guertler, of Berlin, the first foreign member to contribute to the proceedings of the Institute.

On the academic side three sugestive papers are promised Dr. Walter Rosenhain and Mr. Archbutt, of the metallurgical department of the National Physical Laboratory, are contributing jointly an account of a research into "The Constitution of the Aluminum-Zinc Alloys." The author of a paper that was much discussed at the January meeting, Mr. C. A. Edwards, M. Sc., deals fully with his critics in his "Further Note of the Nature of Solid Solutions," whilst Mr. J. L. Haughton, M. Sc., presents an account of a useful research dealing with volume changes in the alloys of copper with tin. These papers in full or abstract will be published in forthcoming issues of THE METAL INDUSTRY.

STANDARD SPECIFICATIONS

We publish in this issue of THE METAL INDUSTRY a letter from Ernest Lewis, a metallurgist of note, of Birmingham, England. Mr. Lewis' letter, which will be found in "Criticism and Comment," is extremely interesting in that it reflects an English view of the proposed standard specifications for copper, spelter and manganese bronze, published in the June issue of THE METAL INDUSTRY. Mr. Lewis raises some very important questions regarding the requirements for commercial copper, both in regard to the chemical composition and to the proposed method of procuring samples for assay. The specifications for spelter more nearly meets with Mr. Lewis' approval, and he has only one or two suggestions to make. The specifications for manganese bronze he does not consider as covering the case at all, and asks some very pertinent questions. We should like to see these questions answered by the committee that prepared the specifications for adoption.

In particular, the point raised concerning the percentage of manganese to be found in a manganese bronze ingot is worthy of serious consideration. As the specification now stands, it would shut out the product of certain manufacturers that shows upon analysis upwards of three per cent. of manganese. Some distinction might be made and split manganese bronze into two classes, according to the purpose for which it is to be used.

Mr. Lewis' proposal to divide the specification for copper into four or more classes strikes us as a very good one, and we hope to see it adopted in some form. As the proposed specifications are now being subjected to letter ballot by the members of the American Society for Testing Materials, this is a good time to make such changes and revisions as seem necessary. Then, if they are presented to the International Body at the twelfth congress to be held in New York next year, there will be less chance for a rejection by that body, as predicted by Mr. Lewis.

NEW BOOKS

The tenth annual edition of the Copper Handbook will be published on September 15 by Mr. Horace J. Stevens, of Houghton, Mich. Eighteen months have been spent in an absolutely complete revision of the mine descriptions and statistical section of the book. The new edition, Vol. X, will contain 1,902 octavo pages of text, and will list and describe 8,130 mining companies, mines and attempts at mines, this being much the largest number of titles given in any work of reference on mines. As in preceding years, there will be several hundred pages of preliminary chapters, devoted to the technology and uses of copper.

CRITICISM AND COMMENT

WE CORDIALLY INVITE READERS' OPINIONS AND CRITICISMS OF ARTICLES PUBLISHED IN THE METAL INDUSTRY. SUGGESTIONS WELCOME.

STANDARD SPECIFICATIONS

To the Editor of The Metal Industry:

If the standard specifications* governing the sale and purchase of the virgin metals, copper and spelter and manganese bronze, proposed by the American Society for Testing Materials, are intended to be recommended to the International Society for Testing Materials, as an international standard, English engineers and metallurgises will probably reject them. Take the case of copper: In the explanatory note it is stated, "It is intended to cover in these specifications an average grade of copper suitable for all mechanical uses and for making wrought forms." Such a thing is an impossibility, no single specification can be made to suit all forms of copper. Surely American railways and other large consumers have found out the superiority of tough arsenical copper for tubes or firebox plates, over the 99.88 per cent. material, it is suggested, should be used. Conductivity is not the only test to take into consideration, if copper is wanted, that will wear well. Copper of 99.88 per cent. purity is too soft for average mechanical uses. It could be made harder with the addition of 0.05 per cent. phosphorus, but this metalloid is not mentioned in the proposed specification. I do not think it would stand the conductivity test. Arsenical copper is summed up very shortly. "It shall have a conductivity of not less than 90 per cent. annealed," so says the specification. Why? Arsenical copper is not used for electrical work, it is used for its wearing properties. An electrical conductivity test for such copper is valueless. No mention is made of limiting the lead contents, which is highly important. The proposed specification says copper, in all shapes, shall have a purity of 99.880 per cent. Why mention the third place of decimals? If you sent a thoroughly representative sample of five tons of such copper to three different analysts, you might easily get a difference of .03 per cent. between the results. Presumably, copper of 99.86 per cent purity would be rejected. Why? I have seen excellent copper of the English best selected quality of 99.7 per cent. purity. The only copper which needs high purity and high conductivity is copper for electrical purposes. Is there no necessity for a tensile test for billets after rolling, also a flattening and bending test and, in the case of tubes, an opening test?

The way it is proposed to sample the metal for metal contents is open to serious objection. Practical men know it is possible for a furnace charge to vary as much as .05 per cent between the ingots at first poured and those poured last, and yet it is suggested that drillings taken from two ingots out of a carload (or four, it is not quite clear) are sufficient to test the quality. To make such a test reliable, drillings should be taken from five per cent. of the ingots, in the case of billets or any form for rolling the holes should be drilled at the end. There is, obviously, certain work for which arsenical copper would not suit; copper for brewery vats, for instance. The difficulty of American makers of copper to produce a good wearing copper, is the excessive purity of the raw material. Pure copper is excellent for electrical purposes and alloys, but quite unsuitable for hard usage. Our American friends are very proud of the fact that their machinery is superior to the English standard and English manufacturers have been blamed for their old-fashioned ideas, but in the matter of quality of metals for wearing properties, English makers are far ahead of American. In England we buy hundreds of tons of American brass borings, melt them down with the addition of the necessary spelter, and make them into wire, sheets and tubes, brass ingots. Can our American friends do that?

The proposed specifications for spelter are not so bad. The amount of cadmium allowed in the intermediate quality and brass special is far higher than I would allow. The maximum of cadmium in spelter should not exceed .25 per cent. There is no difficulty in getting such spelter in England. No mention is made of tin in the spelter specification. I have often come across genuine distilled spelters with .01 per cent to .03 per cent. tin. For purposes of analysis, it is better to take drillings than sawings. The method given for determining cadmium is, I think, open to objection. In my opinion, the method of dissolving the spelter in diluted sulphuric acid and estimating the cadmium in the filtrate and also estimating the portion possibly left with the lead, is far better.

The proposed specification for manganese bronze ingots is open to considerable objection. What maker of manganese bronze would put 60 per cent. copper in his ingots. The composition should be limited from 50 per cent. to 58 per cent. copper, and the spelter in proportion. The tin is not to be over 2 per cent. I should think not! The maximum should not much exceed 1.3 per cent. Why should the manganese be limited to 0.5 per cent. For metal for rods, I should prefer 2 per cent. manganese and 0.5 per cent. iron. The aluminum should not be more than 0.25 per cent. Why is not the percentage of lead mentioned? It is absolutely essential it should be limited to 0.05 per cent. One test ingot to represent 10,000 pounds of ingot metal is about on a par with taking a single turning from a five-ton parcel of turnings and analyzing it to find the percentage of copper in the bulk. Standard specifications to be of any value must be practical. I should hardly think any refiner would attempt to supply metal to the proposed standards, especially the one proposed for copper.

If the American engineers accept the proposed standard specification for copper, then they will not be getting the best metal from the point of view of resistance to errosion and wearing properties. The specifications must be divided into parts, for instance:

1. Copper for electrical work, which must be of high conductivity and assaying on the average 99.8 per cent. to 99.9 per cent. copper.
2. Electrolytic cathodes, which must assay over 99.85 per cent. copper and contain less than .005 per cent. bismuth.
3. Ingot copper for alloys, which must contain on an average 99.7 per cent. copper.
4. Billets, cakes and slabs for making into tubes, rods, plates, etc., must contain from 0.4 per cent to 0.6 per cent. arsenic, not more than 0.1 per cent. lead, and be free from bismuth and antimony.

Phosphorized copper for tubes, containing about 99.8 per cent. copper and .05 per cent. phosphorus.

Ernest Lewis.

Birmingham, England, August 2, 1911.

*The Metal Industry, July, 1911

TIN PRICES AND BABBITT METAL

To the Editor of The Metal Industry:

One of the most interesting features in connection with the present abnormally high price of pig tin is its effects, not only on the price of genuine Babbitt metal, but on the quality and sale of this material. The following remarks are equally true of solder, as many a customer has found out to his cost, but as genuine Babbitt Metal contains from 80 to 90 per cent. tin, and solder usually only from 40 to 50 per cent., this matter becomes of much more importance to the genuine Babbitt metal users. When tin was selling at from 27 cents to 30 cents the price of genuine Babbitt metal was apprixomately the same; but when tin advanced to 46 cents per pound, Babbitt metal naturally followed suit. Some smelters finding that their customers object to paying these increased prices, and fearing loss of trade, oblige the customer by not increasing prices, but, of course, the only way they can do this is by taking it out of the quality, by putting in lead in the place of tin; some use impure grades of tin, but as the impurities consist mostly of lead, this amounts to the same thing.

J. E. Cauffman, manager of the Babbitt metal department of Merchant & Evans Company, 517 Arch street, when interviewed on this subject said: "Among the samples I have tested I have found some contain not only 5 per cent. or 10 per cent. of lead, but even as high as 30 per cent., and these metals were actually sold as genuine Babbitt metal and at a corresponding price." If, therefore, the dishonest smelters reduce the price 5 cents per pound below the honest manufacturer's price, he would probably even then be making 5 to 10 cents per pound extra illegitimate profit, while the honest manufacturer would be losing a good deal of trade on a comparison of prices. If we stop to consider that with tin at 46 cents per pound and lead at 4½ cents per pound, every part of lead substituted for one of tin means an extra profit of $0.415 per cwt. to the dishonest smelter; or with a substitution of 20 per cent. the extra profit would be $8.30.

Even if the customer does not object to making others rich while he is the victim, yet if he will consider the danger of using highly adulterated Babbitt metal in high-grade machinery, with the risk of breakdown at any time, he may find that it does not pay to be tempted by low price alone. Some may wait until they have been swindled a few times, others may not wait so long before they cease to be attracted by these alluring prices; but sooner or later they will all find out that it only pays to buy this material from a reliable, high grade house. Some cover the deception by calling the metal "Commercial Genuine," or a similar name, which are only evasions, because the manufacturer has not the courage to lie outright, but whips the devil around the stump. Needless to say this practice has been extremely injurious to the honest smelters, but there are still some of the latter class who are continuing honest for honesty's sake, and who will not reduce the quality of their products for any consideration.

C. H. Congdon.

Philadelphia, Pa., September 6, 1911.

Shop Problems

IN THIS DEPARTMENT WE ANSWER QUESTIONS RELATING TO SHOP PRACTICE OF THE METAL INDUSTRY. ADDRESS THE METAL INDUSTRY.

ALLOYING

Q.—We are requiring a white metal that will expand in cooling. Can you give us the component parts of this through the columns of The Metal Industry?

A.—The following formula gives a good fusible metal of low shrinkage:

Tin	16.7
Lead	75.0
Bismuth	8.3

Care should be taken not to overheat this alloy, and it should be poured at a low temperature.—J. L. J.

BRIGHTENING

Q.—Will you please publish a formula for brightening articles after being hot tinned?

A.—For brightening tin after hot tinning the usual method employed is to immerse in kerosene oil, then drain well and rub in a cheap wheat flour. Seconds or thirds are usually purchased for the purpose.—C. H. P.

CASTING

Q.—Will you kindly inform us as to the best way to obtain good, bright and smooth casting of a fusible alloy?

A.—The fusible alloys all oxidize very readily, hence they should never be overheated. To obtain castings of the character you desire, we would suggest that you try the die casting process. —J. L. J.

Q.—We are making yellow brass castings for automobile mountings from sheet brass scrap, borings, and very little new metal, and are bothered a great deal with small black spots which show up on the castings. Can you locate the trouble?

A.—Your castings are porous and the small black spots are due to buffing dirt in the blow holes. Light scrap brass oxidizes very readily in melting and does not make sound castings. We would advise running down your mixture into ingots, adding ¼ per cent. manganese copper and then remelting.—J. L. J.

CEMENTING

Q.—We have an article, made of two parts joined together, one being entirely hollow, which we nickel or silver plate. We want to plug up these holes so that the acids will not get into the hollows of the article during plating. Can you recommend such a material?

A.—One of the following methods will probably answer your purpose: First, mix powdered chalk with silicate of soda to a paste; fill up the holes and let the cement dry before the regular cleansing operations. Second, mix finely powdered glass in the same manner. Third, mix litharge with glycerine to a stiff paste. When this cement becomes thoroughly dry it is practically insoluble in the alkalies or strong acids. The cement can be removed with any sharp steel tool.—C. H. P.

CLEANING

Q.—Would an electric cleaner be suitable for bright polished brass work to prepare same for the nickel and silver baths, and if so, what would the electrolyte consist of?

A.—An electric cleaner for polished brass should not contain a caustic alkali or a cyanide. The best results should be obtained by the use of a ten per cent. solution of carbonate of soda and a reversed current. The solution should be used at a temperature of 180 degs. on account of the slower solvent action upon the buffing dirt when a carbonate is used.—C. H. P.

COLORING

Q.—Will you kindly give me an acid coloring solution for solid gold 18-k jewelry? Please state if the acid coloring solution is used as a dip or with the electric current.

A.—The acid process of coloring, like the fire-gilding process, is such an unsatisfactory and wasteful method of obtaining a fine, gold color as compared with coloring in cyanide-gold solution or a salt-water solution that it cannot be recommended. If you have not the facilities for running the cyanide-gold or salt solution, the following will give a rich, yellow color to the articles and is easily regulated:

Boiling Water	1 gal.
Nitrate of Potassium	6 ozs.
Alum	3 ozs.
Sulphate of Zinc	3 ozs.
Common Salt	3 ozs.

The jewelry to be colored in the above solution should be cleaned as for plating, then boiled in a weak nitric acid pickle, then boiled in the coloring solution until the articles assume a dead, yellow appearance. Finish by scratch brushing or burnishing as desired. If the articles do not come out yellow enough add nitrate of potassium. If the articles are wanted as smooth as possible omit the sulphate of zinc; if a heavy matt is desired, increase quantity of same. The solution must be used boiling and cannot be used on gold that is lower than 14-k.—O. A. H.

DEPOSITING

Q.—We require a solution for depositing a good coating of lead. A solution of lead acetate in cyanide has been tried, but is not satisfactory. We have also tried a solution of litharge in caustic potash, but the solution was thin and powdery. If there

are no other solutions known would you kindly give us instructions for making the two mentioned above?

A.—Probably the most successful solution for electro depositing of lead is the one proposed by Frank C. Mathers, in a Paper presented at the meeting of the American Electrochemical Society, held in Pittsburgh, Pa., in May 1910, consisting of lead perchlorate with free perchloric acid and the addition of peptone as a toning agent. According to the author the solution should be composed as follows:

Water	1 gal.
Perchlorate of lead	5%
Free perchloric acid	2.5%
Peptone	0.05%

Voltage 2 to 3; amperage 18 to 27 per square foot of surface.

The following proportions are used in connection with the other lead baths.

(1) Water	1	gal.
Caustic potash	12	ozs.
Litharge	1½ to 2	ozs.
(2) Water	1	gal.
Acetate of lead	1½	ozs.
Acetic acid	2	ozs.

A solution consisting of dry carbonate of lead dissolved in cyanide of potassium may give you results. We suggest that you try a bath consisting of

Carbonate of lead	2 ozs.
Potassium cyanide	8 ozs.
Water	1 gal.

Use anodes of commercial sheet lead.—C. H. P.

DROSSING

Q.—Kindly tell us the best means for preventing the formation of a skin on the top of a metal bath containing 60 parts of tin and 40 parts of lead. We use this bath for dipping the ends of bundles of brass tubes.

A.—As a flux, sprinkle sal ammoniac, which is frequently termed muriate of ammonia, upon the surface of the molten metal and then skim from the surface. This dross should be saved and remelted when sufficient has been accumulated. Avoid using too great a heat in melting to provide against oxidization.—C. H. P.

ENAMELING

Q.—We are doing some etched plate work in our factory, and do not seem to have the right colors for this class of work. Can you tell us who makes the enamels for these plates, how it is applied and the surplus taken off so cleanly? We understand about the black finish on these plates, but it is the colors with which we have trouble.

A.—We would advise you to correspond with Berry Brothers, Ltd., Detroit, Michigan, who manufacture soft enamels for jewelry workers. These enamels can be easily removed from the high lights by using felt moistened with turpentine and linseed oil, mixed in the proportion of one of turpentine to ¼ to ½ part of linseed oil. The secret of applying these enamels is to lacquer the surface first and when hard and dry apply the enamels; this makes the enamels stick, and they become easy to remove from the surface.—C. H. P.

FINISHING

Q.—Please let me know how to produce the dull or dead brass finish.

A.—The easiest way to produce this finish is to cut down your articles with tripoli to produce a smooth finish; then cleanse as for plating and scour down with a tampico brush, using pulverized pumice stone and water. Afterwards wash, put through a dilute cyanide solution and dry out by the aid of boiling water and ample sawdust in the regular way. Now lacquer with what is termed a brush brass lacquer. Instead of using a tampico wheel a brass wire scratch brush can be used, one that is worn down considerably gives the best results. Use the pumice stone, applying just a little to the articles and brush lightly; then finish as stated above.—C. H. P.

PLATING

Q.—Some time ago, a small amount of sulphate of copper was added to our nickel solution by mistake, and at about the same time the nickel commenced to come dark and muddy-looking. Would the addition of a small amount of copper have this effect, and if so how can we remove the copper?

A.—Your nickel solution was undoubtedly spoiled when the sulphate of copper was introduced, as a very small amount will blacken the deposit. Although, theoretically, the copper can be precipitated as a sulphide, by passing hydrogen sulphide gas through the solution, and then filtered out, the most practical thing to do is to sell the solution to a refiner and make a new one.—O. A. H.

Q. We have considerable trouble in plating a lead coated tin shell with hot solutions. The difficulty is after the shell is plated it becomes so brittle that in double seaming the bottom to the shell, a great many of them crack. Can you suggest a remedy?

A.—We have given your inquiry considerable thought, and yet we are unable to determine the exact cause of the trouble. In the manufacture of brass goods, especially with spun or drawn goods when not annealed, shells very frequently crack in a like manner. This is termed season cracking, and the theory has never been scientifically explained, except the unequal expansion of the metals composing the brass (copper and zinc). The only solution we can offer is to maintain the heat of your copper solutions as low as possible to avoid too great an expansion, and at the same time use as little free cyanide as possible, as cyanide has a tendency to harden steel, especially when very thin. We would suggest that you try the method of flushing the steel goods in a nickel bath for a few minutes previous to coppering. You may find that this will solve your problem.—C. H. P.

Q.—Can you give me a complete formula for a nickel-silver solution, one that contains about 65 per cent. nickel and 35 per cent. silver? It must give a good hard desposit in about five minutes or less, that will stand coloring, with the brightness and luster of silver and the hardness and durability of nickel.

A.—If you are using a combination silver and nickel solution, why do you not experiment further in an effort to get what you require. We do not believe you will be able to deposit 65 per cent. nickel and 35 per cent. silver and get the whiteness of silver. This might be accomplished with 50 per cent. each. For the purpose you should use cyanide of nickel and cyanide of silver. The anodes should consist of the same percentage of each metal. We would suggest that you make up a ten-gallon solution of 50 per cent. of each salt and then try out, gradually increasing your nickel content until the 65 per cent. is reached.—C. H. P.

SOLDERING

Q.—Can you give me a good soldering flux for soldering tinned iron plates?

A.—A good soldering flux for your purpose should consist of the following:

Chloride of zinc	1 part by measure
Glycerine	1 part by measure
Wood or denatured alcohol	1 part by measure

Chloride of zinc is prepared by adding sheet zinc to muriatic acid until the acid is completely saturated with the metal.—C. H. P.

STAMPING

Q.—Can you give us any information on the usual process of softening ordinary zinc sheets for stamping purposes, and whether any furnaces are required for the purpose?

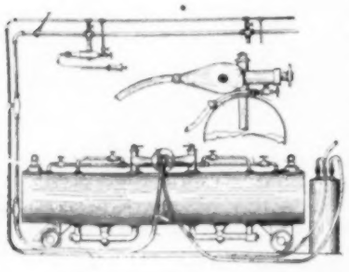
A.—Zinc sheets for stamping purposes should be procured soft. It should not then be necessary to anneal during the operations unless there is an unusual depth to the stampings. The secret of working zinc is to use kerosene oil as the lubricant instead of the usual oils used with brass. Annealing can be done if required with a Bunsen flame. It is only necessary to take out the temper, which can readily be done at a temperature of 400 degs. F.—C. H. P.

PATENTS

REVIEW OF CURRENT PATENTS OF INTEREST TO THE READERS OF THE METAL INDUSTRY.

998,111. July 18, 1911. Sand Blast Apparatus. J. D. Murray, San Francisco, Cal.

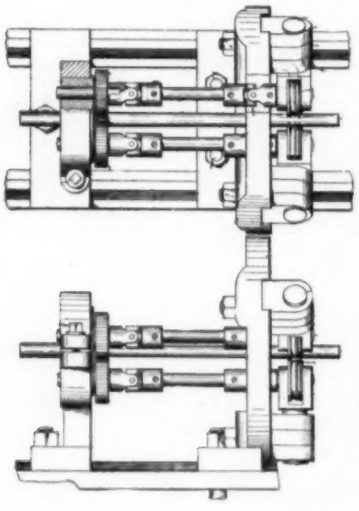
This invention relates to improvements made in apparatus or appliances for scouring, cleaning, cutting, abrading or finishing surfaces of wood or metal by what is technically termed the "sand blast." The invention has for its object to provide a sand-blast apparatus, shown in cut, of large capacity for doing work on a large scale and under conditions where the surface to be operated on, or the work to be done, may be situated above the apparatus at a considerable distance from the ground, or from the place where the supply tank and air-compressing plant are stationed.



A further object of the invention is to provide means for moving the sand or other solid material through a conducting pipe for a considerable distance horizontally, for raising it through a perpendicular conductor by pneumatic pressure applied under such conditions that any liability of clogging or choking the material will be overcome and the material will flow to the sand-blast nozzles under uniform pressure when the jets are working at considerable distance from the supply.

998,214. July 18, 1911. Spiral Tube-Making Machine. J. W. Wallis, Waterbury, Conn.

This invention relates to new and useful improvements in a spiral tube making machine, referring more particularly to that type of machine wherein a flexible metal hose is formed from a strip of sheet metal.



It is the object of the invention, among other things, to provide a machine of this character, shown in cut, that will fold the flat metal strip so as to produce the desired construction and coil the same into a flexible hose wherein the winding operation will be continuous and not intermittent, as in some machines; to provide means for positively driving the forming rolls; and in other ways to construct a hose winding machine that will be effective and economical in its operation, and composed of the fewest possible parts, so designed that they may be manufactured at the minimum cost and readily assembled.

998,777. July 25, 1911. Alloy. J. L. Jones, Wilmerding, Pa., assignor to Westinghouse Electric and Manufacturing Company, Pittsburgh, Pa.

The object of this invention is to provide a composition or alloy to be cast, forged or otherwise formed into articles and machine elements which shall have an exceptionally high degree of resistance to any and all strains to which they may be subjected

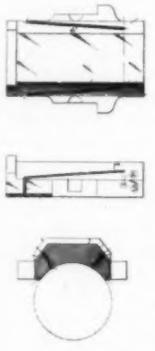
In manufacturing the alloy which constitutes the invention, the inventor employs a hardener composed of tin, ferro-manganese and magnet or high speed tool steel or some other special steel, preferably in the form of small crop ends or turnings, these constituent elements of the hardener being preferably combined in substantially the proportions of 30, 7½ and 62½ by weight, although such proportions may be considerably varied, in practice. He then combines from fifty-one to sixty-four parts of copper, from thirty-five to forty-five parts of zinc, from one-sixth of one part to fifteen parts of the hardener above specified, from one-sixth of one part to three parts of tin, and from one-sixth of one part to eight parts of aluminum, in case the composition or alloy is required for castings.

The high speed tool steel which is employed as one of the constituent elements of the new alloy consists of approximately 80 per cent. iron, 18 per cent. tungsten and 2 per cent. Chromium, but variations from these percentages are of course permissible. The magnet steel consists of approximately 95 per cent. iron and 5 per cent. tungsten, but these percentages may also be varied somewhat, if desired.

One of the claims of the patent is: An alloy containing fifty-one to sixty-four parts of copper, thirty-five to forty-five parts of zinc, one-sixth of one part to three parts of tin, and one-sixth of one part to fifteen parts of a mixture of ferro-manganese and steel having tungsten as one of its constituent elements.

998,914. July 25, 1911. Car Axle Journal-Brass. F. A. McArthur, Springfield, Mo.

The car axle journal-brass shown in cut is intended to provide for serving as a means for transmitting the lubricant in the car axle box in which the brass is used from the front end of the box to the rear end of the brass.



As is well known, there is a constant source of trouble and annoyance in car axle boxes due to heating of the brasses, as a consequence of lubricant placed in the boxes being insufficiently supplied to the rear or inner portions of the axle journals, and the bearing surfaces of the brasses contacting therewith. This is due to the fact that when the original supply of lubricant placed in the box has become diminished or exhausted, the lubricant that is introduced into the box at its forward end to replenish the supply remains in the main, if not entirely, in the front end of the box, so that there is no replenishment of the lubricant at the rear end of the box to lubricate the journal and its brass at this point. By this improvement, means are provided for a sufficient amount of the lubricant present in the front end of the box being transmitted or transferred by the bearing or journal brass to the rear portion of the brass and the journal on which it operates.

959,568. August 1, 1911. Electrolyte and Method of Depositing Zinc. E. F. Kern, Knoxville, Tenn., assignor of one-half to Percy S. Brown, Howthorne, Ill.

Heretofore in the electrodeposition of zinc it has been necessary to employ current having a high electromotive force in order to obtain satisfactory results. Now it has been discovered that a dense coherent and adherent deposit of zinc may be obtained by the electrolysis of a bath containing a chlorid of zinc and a chlorid of another metal, as aluminum or sodium, preferably combined in the form of a double chlorid of zinc and the other metal, and that particularly good results are obtained by the electrolysis of a bath containing a double chlorid of zinc and aluminum and an alkaline chlorid, preferably sodium chlorid.

It has also been discovered that the addition of an organic material hereinafter termed "organic addition agent" such, for example, as grape sugar, the bath improves the operation of the process and particularly improves the appearance of the deposits. It is found that zinc can be satisfactorily deposited from the improved electrolyte by the use of current of high amperage and low electromotive force, thereby overcoming the disadvantage of prior zinc electrolytes which require a current of very high electromotive force for their satisfactory use.

The following examples will serve to illustrate the preferred ingredients and proportions employed in producing electrolytes embodying the invention:

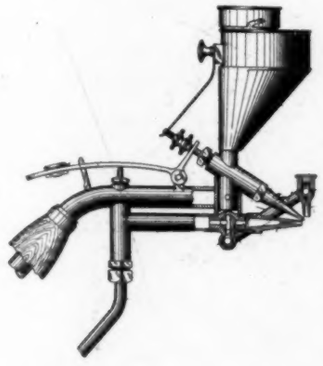
Example No. 1: water 100 parts, zinc chlorid ($ZnCl_2$) 10 parts, aluminum chlorid ($Al_2Cl_612H_2C$) 6 parts, grape sugar 4 parts.

Example No. 2: zinc chlorid ($ZnCl_2$) 10 parts, aluminum chlorid ($Al_2Cl_612H_2O$) 4 parts, sodium chlorid (NaCl) 3 parts, grape sugar 4 parts.

In the use of an electrolyte, corresponding to Example No. 1, satisfactory results were obtained with a current having an amperage of 25 amps. sq. ft. the E. M. F. being from .80 to .81 volts, and the temperature of the electrolyte being from 45 degs. to 55 degs. Cent. In the use of an electrolyte, corresponding to Example No. 2, satisfactory results were obtained by the use of a current of .67 to .70 volts, the amperage being the same as in the case of Example No. 1 and the temperature of the electrolyte being as before, from 45 degs. to 55 degs. Cent.

999,330. August 1, 1911. Paint or Color Dispenser With More Than One Air-Nozzle. H. Mikorey, of Schoneberg, near Berlin, Germany, assignor to Minimax Consolidated, Ltd., Berlin, Germany.

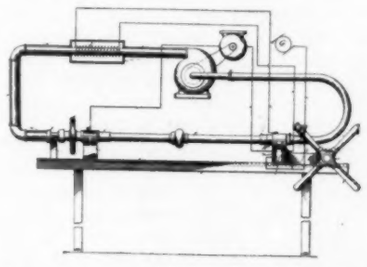
The sprayer shown in cut is constructed so that one nozzle for delivery paint or color corresponds to several air nozzles of which at least one is adjustable, with a view of being able to effect a sprinkling even in a very steep or perfectly vertical direction without undue inclination or without any inclination at all of the disperser or sprayer.



The machine is covered by three claims, the principal one being: In a paint or color disperser or sprayer, the combination of a paint or color nozzle, with two air nozzles arranged below and above the paint or color nozzle respectively an air conduit, two telescopic tubes, one of which is joined to said air conduit, while to the other the said air nozzle arranged above the paint or color nozzle is jointed, and a controlling device connecting the air nozzles independently of each other to said air conduit.

1,000,412. August 15, 1911. Lacquering Heating System. J. L. Isaacs, Red Bank, N. J.

This invention relates to lacquering heating systems, particularly to systems in which metallic pieces such as tubes, sleeves or the like for bedsteads are to be continuously heated while coats of lacquer are applied thereto.

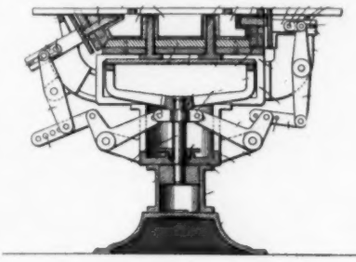


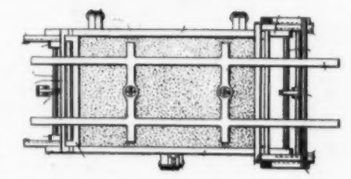
In applying lacquer to metallic parts, in order that lacquer may be uninterruptedly applied coat after coat, it is necessary that the parts be kept at a temperature which will dry one coat as fast as it is applied so that succeeding coats can be applied without interruption and loss of time. The parts to be lacquered must also be heated uniformly and the heating means must be such that the heat will be confined to the system and will not radiate to make it uncomfortable for the operators.

The main object of the invention is to provide mechanism, as shown in cut, which will cause circulation of heating medium such as hot air through a fixed path into which path a part to be lacquered can be included so that the hot air will flow through the object to uniformly heat it during the lacquer application process.

1,000,205. August 8, 1911. Molding Machine. G. W. Southwick, Quincy, Ill.

This is a machine, as shown in cut, designed for making molds for castings, and one of the objects of the invention is to produce a machine of this character whereby molds will be produced from the green sand without the use of cores, one in which an arbor is employed provided with a plurality of keys whereby the mold is effectively supported.

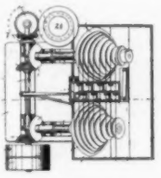


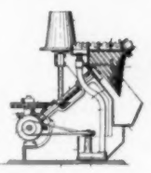


Other objects of the invention are to produce a machine of this character, the parts of which are so constructed and arranged that the patterns may be withdrawn simultaneously from the sand in different directions, and the mold supported by a removable arbor, which may be readily removed from the flask.

1,000,492. August 15, 1911. Wire-Drawing Machine. E. H. Carroll, Worcester, Mass., assignor to Morgan Construction Company, Worcester, Mass.

This machine, shown in cut, is an improvement in that class of wire-drawing machines in which the wire is drawn through several successive dies in a continuous operation. The inventor claims among other things the following:

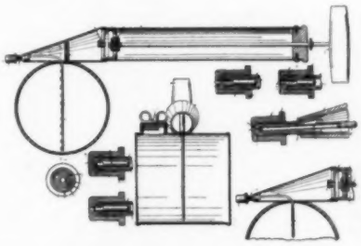




In a wire drawing machine, the combination with a pair of conical wire drawing capstans having straight sides from the bottom to the top with circumferential grooves, said capstans mounted to bring the upper side horizontal, of a die box between said capstans with its bottom horizontal, and means for driving said capstans, said capstans formed with the opposite sides substantially at an angle of ninety degrees to each other, whereby the lower sides of said capstans, mounted with the upper side horizontal, are approximately vertical, thereby bringing all the grooves of the capstan at the front of the machine.

1,000,447. August 15, 1911. Sprayer. De Wane B. Smith, Deerfield, N. Y.

The purpose of this invention is to provide a hand sprayer of simple construction yet adapted to throw a continuous spray, and having means to easily regulate the fineness of the spray.



In operating the sprayer shown in the cut, the liquid receptacle is filled and herein lies one of the advanages of the invention in providing a separate air chamber. Heretofore many sprayers have been constructed in which the top of the liquid receptacle has acted as the only air chamber, necessitating the partial filling only of the liquid receptacle and giving very uncertain and unsatisfactory spray at the beginning.

INDUSTRIAL

NEW AND USEFUL DEVICES, MACHINERY AND SUPPLIES OF INTEREST TO THE READERS OF THE METAL INDUSTRY.

MODEL GALVANIZING AND TINNING PLANT

The galvanizing and tinning plant of Wilcox, Chittenden and Company, of Middletown, Conn., which was completed in December, 1907, may well be taken as an example of the most up-to-date practice in the galvanizing and tinning of metal goods. The Wilcox Chittenden people were among the pioneers in job galvanizing in this country, and used the process as early as 1855, thus giving them an active experience of over half a century. In Fig. 1 we show one of the largest galvanizing baths containing 50,000 pounds of molten spelter. In this bath are galvanized anchors, ladders, awning frames, metal park benches, pipes, bars and castings. The main galvanizing building in which this tank is located is 200 feet long and 45 feet high, with two wings, each of which is 111 feet long. The entire floor space covers an area of 20,000 square feet, and the daily capacity of the plant is 100,000 pounds.

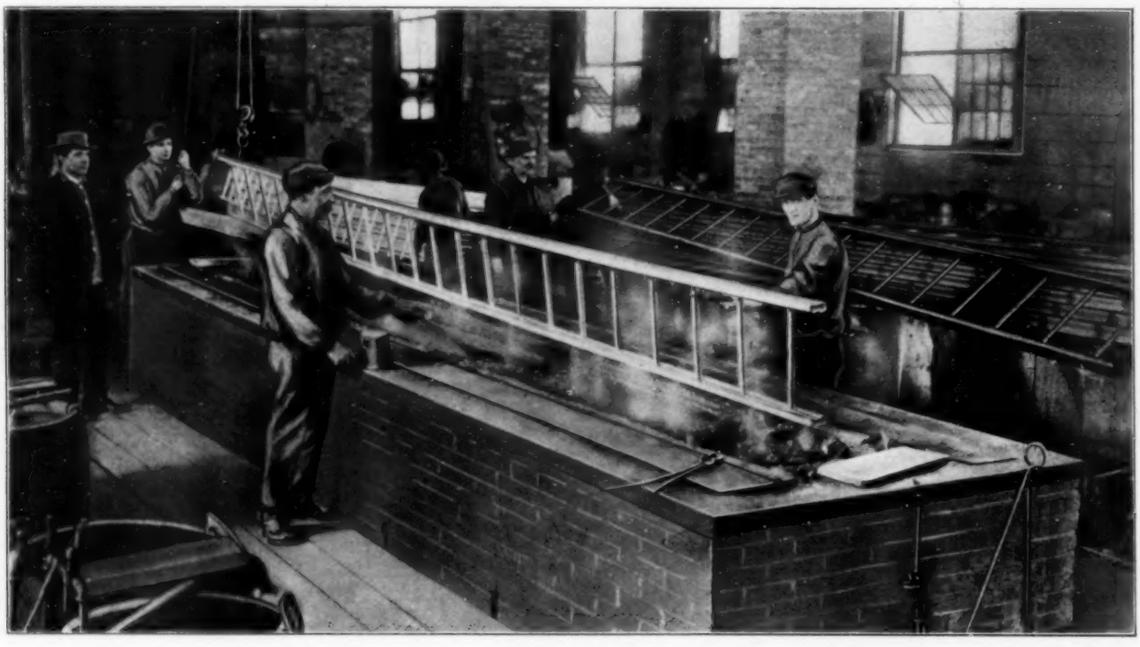


FIG. 1. GALVANIZING TANK, 40 FEET LONG, HOLDING 50,000 POUNDS OF MOLTEN SPELTER.

In the erection of the plant it was the company's intention to make it the most complete of its kind in the world, and one that would not only enable them to take care of their own manufactured product, but also put them in a position to meet the demands of their rapidly increasing jobbing trade. In point of light, ventilation, complete drainage, and acid proof flooring, the most modern plans were carefully followed throughout. The interior equipment of pickle vats, tumbling barrels, service kettles, industrial railways, etc., is so arranged that material can be handled to the best advantage, and easily carried from step to step while in process with the least labor and in the quickest time. The range of work handled by this company is wider than that of any other concern in the country. The largest galvanizing kettle, as shown in the cut, Fig. 1, holds as said, 50,000 pounds of metal, and will accommodate material up to 40 feet in length. In addition to the facilities for handling large work there is also installed patented equipment to take care of such small articles as tacks, nails, burrs, etc., and a specialty is made of treating threaded material by the hot dipped galvanizing process, and in such a manner as to leave the threads clean and perfect, yet thoroughly coated with zinc. An installation for this purpose is shown in Fig. 2.

As will be surmised the only process for galvanizing used by this company is that known as the "Hot Dip," in which only "Prime Western Spelter" is used. They say:

"Our entire line of material requires to be galvanized, and is subjected to the most severe exposure under atmospheric conditions which are particularly productive of corrosion, and we have never used anything but the hot dipped galvanized process to protect our goods. We have, however, kept an open mind, and have investigated all new methods of rust proofing. As a result of our investigations and experiments, we are still convinced that the hot process galvanizing is the most durable, and in the long run by far the cheapest. The results obtained by this method are uniform and satisfactory—the coating of zinc will last."

In addition to the extensive line of galvanized ware that this company makes, they have also a tinning plant equipped for handling a wide range of work, and make a specialty of tinning gray iron. They also call attention to the fact that they were the originators of the gray iron tinning process. Gray iron for commercial purposes was first tinned in their plant in 1876 through a process devised by the late Chas. D. Mowry, who was then in charge of the tinning and galvanizing departments. For several years they were the only concern who tinned gray iron. We have constantly improved their methods, and today maintain the highest standard on work of this character.

Wilcox, Chittenden & Company claim to be generally recognized as the largest manufacturers of marine hardware. In all parts of the world their galvanized goods are in actual service under the most severe conditions. In their effort to better if possible the quality of their product they have carefully investigated all methods of rust-proofing metals that have been pro-

moted by others and have not found any coating equal to the one they provide by the hot process. It successfully stands the test of long service and they are firmly convinced that it is the best method in existence. Among their customers for galvanizing are the United States Navy, War and Post Office Departments, also many of the most prominent manufacturers of harware, sporting goods and electrical supplies. The above firm will be pleased to tell more about their processes and to show samples of their goods to those interested in galvanizing or tinning, address Wilcox, Chittenden & Company, Middletown, Conn.

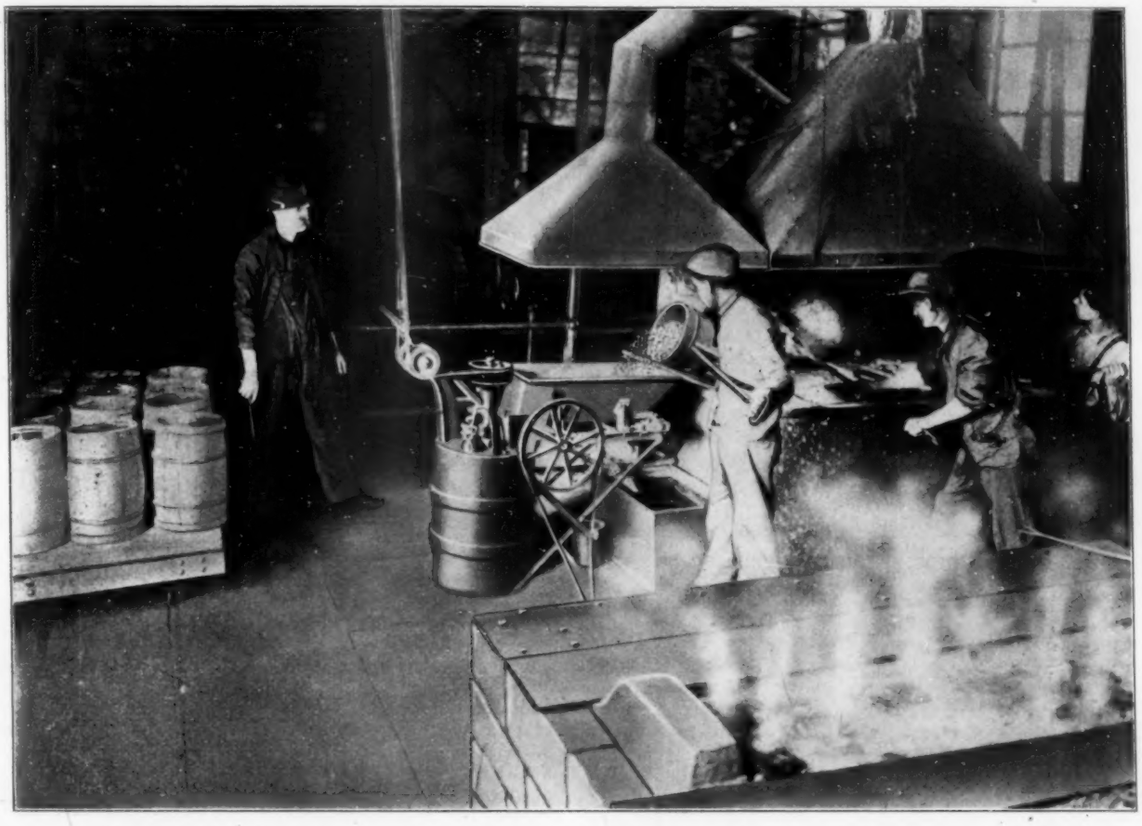


FIG. 2. PLANT FOR THE TINNING OF NAILS, TACKS, SCREWS, BURRS, ETC., IN LARGE QUANTITIES.

ACETYLENE WELDING AND CUTTING MACHINE

By J. P. Springer

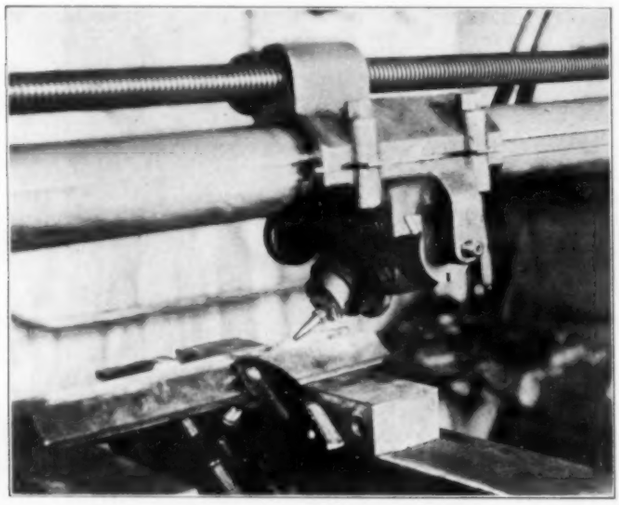
Hand welding and hand cutting are now familiar operations to which the acetylene blow-pipe is highly adapted. Where straight-line operations have to be carried out, especially in connection with repetition work, a machine is often applicable and advisable. Where sheets are very thin, machine welding is very desirable because of the certainty with which it can be regulated. The machine can be advantageously used in sheet-metal work, where the thicknesses range up to, say, 3/16 or 7/32 inch. Straight cutting of both thin and thick work can be advantageously done with the machine because of the precision of the movement.

An acetylene welding and cutting machine, as shown in Fig. 1, has recently been built by the Davis-Bournonville Company, of 90 West street, New York City, at their laboratory at Marion Station, Jersey City. The patent rights involved are held by this concern. There is a cylindrical upright, perhaps six or seven feet in height. This carries a long hollow arm projecting for six or seven feet on one side. By means of a rack and pinion, this arm may be adjusted to any height desired. The arm carries a long screw, rotatably and horizontally mounted in suitable bearings. At the base of the upright, loose and tight pulleys are mounted on a short horizontal shaft and are driven from an ordinary countershaft above, which contacts with a suitable disk mounted on a vertical shaft. This latter shaft and a rotatable rod arranged in the hollow arm are put into driving connection by bevel gears. At the outer end of the arm, an arrangement of gears enables the inclosed rod to drive the screw. The turning of this screw operates a carriage back and forth horizontally along the arm. Upon the carriage, the torch and its controlling fixtures are mounted. The work is placed or secured on a suitable fixed table. Flexible tubes bring the oxygen and acetylene to the torch. The tip is practically the ordinary form. It is arranged at an angle, say 40 or 45 degs., to the horizontal, this angle being to the rear of the welding movement. The torch then moves over the work much after the way a cowcatcher passes along over a railway track.

The method of welding is often quite simple. Thus, if the weld is to be a flat one and of inconsiderable length, the two pieces are simply clamped in the exact relative positions they are to occupy finally. Room must, of course, be left for the tip to pass. The operation of welding is then not unlike that which occurs with an ordinary shaper. The carriage with the torch moves evenly along at the proper rate of speed. The countershaft, running at say 140 revolutions per minute, operates the short horizontal shaft at about 70 revolutions. It is possible to adjust the friction pinion to vary the angular speed of the vertical shaft from about 70 to about 35 revolutions. Still further reductions of speed may be made by the gears at the end of the arm. Indeed, quite a range of speeds may be obtained by suitable combinations of the gears. The screw has about six threads to the inch, and gives the carriage a speed which may be varied from 3 to 24 ins. per minute. The carriage has a back-and-forth range of 5 ft. 5 ins., which means that a weld of approximately that length may be made. If an angular weld is to be formed, the only difference to be made is in the arrangement of the work. The angle opens downwards and the vertical plane through the line of the weld bisects the dihedral angle. To illustrate by a practical example, we will suppose that it is desired to weld two strips edge to edge at an angle of 90 degs. We place the strips on the sides of an angle bar, clamping them

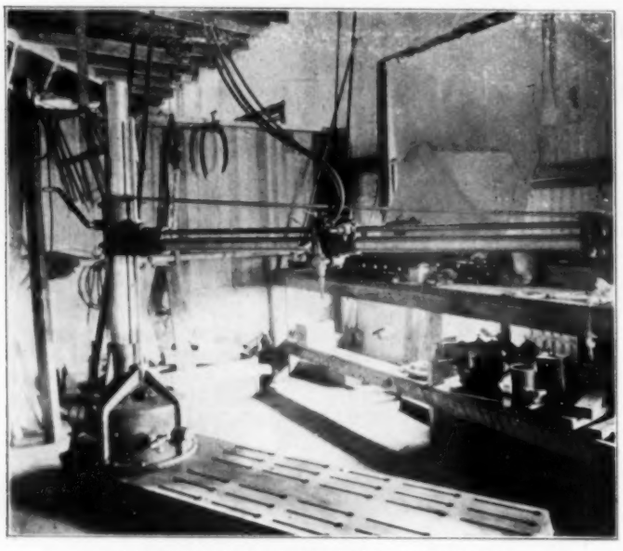
securely in position with clamping strips inserted between the outer faces of the work and the jaws of the clamps.

There is a possible economy which is impossible with hand welding, and which will probably come into pretty general use where the machine is used. The object of using an oxy-acetylene torch is for the purpose of getting a very high temperature. Because of the enormous temperature of about 6,000 degs. F.,



ANGULAR WORK, READY FOR WELDING.

which is claimed for the working point of the little inner flame, this torch is very successful in bringing steel and other metals locally to or near the melting point. Ordinary flames are incompetent for this. But the ordinary and cheap flame is competent to supply a large amount of the requisite heat. Where the form and character of the work do not prohibit, there seems no reason why pre-heating by cheap methods should not be employed. In otherwords, it is not necessary to do all the heating with gases like acetylene and oxygen. The saving is, however,



THE MACHINE RIGGED FOR WELDING.

not connected with the consumption of the gases alone—time may also be saved; and this means economy of the labor and the machine.

The methods of pre-heating may be various. Thus, if it is a question of small repetition work, the pre-heating may in some cases be done subsequent to clamping, but prior to putting the work on the table. Other cases will require pre-heating with the work in welding position. Pre-heating is to be recommended strongly for the two reasons—economy of oxygen consumption and reduction of effects of expansion and contraction.

DOUBLE JET BLOWPIPE

The Turner Brass Works, Sycamore, Ill., are manufacturers of the Turner double jet alcohol blowpipe No. 50, shown in the cut. This appliance is of special interest, because it produces an intensely hot needle pointed blowpipe flame, which can be adjusted to different sizes, thus making it useful for a large variety of work. The burner is mounted on a compound swivel so that the flame can be pointed in different directions. No foot bellows are required for producing this blast flame, as the air pressure is forced into the tank by means of the pump in the handle, thus maintaining a steady blast flame of about 3,000 degrees.

It will be seen that this appliance has a wide range of usefulness in the mechanical trades, as well as for laboratory work,

TURNER DOUBLE JET ALCOHOL BLOWPIPE NO. 50.

and is especially recommended for fine soldering, tempering, annealing and similar work. The flame is clean, and does not corrode the metal, making it excellent for such work as lead burning, gold and silver soldering, and for other purposes where a clean non-oxidizing flame is needed. This appliance is one of a large number of double jet blowpipes and torches constructed for both gasoline and alcohol, as fuel, that are manufactured by this company. They have been favorably known to the trade for several years, and have been recognized for producing a much higher degree of heat than any of the ordinary plumbers' blow torches. The variety includes styles which are suited to fine blowpipe work, as well as extra heavy work, such as automobile brazing, etc.

FIRELESS SILVER

The dark coat on silver and gold, known in the trade as fire in silver and green in gold, has always been a source of annoyance and loss to the manufacturing jeweler. It is customary to strip the articles manufactured to remove the fire or green with a nitric acid dip or by means of a dynamo. This causes more or less loss in the recovery of the strippings and in time and labor. It removes it from the surface only, the fire returning immediately and the surface of the metal becoming coated again if the metal is annealed or soldered.

After many years of experimenting and research William C. Finck, of Elizabeth, N. J., has discovered a method of taking the fire out in the melting. He is selling to the trade a powder, a small quantity of which, if put into the metal just before pouring, he says, will form a chemical combination with the metal and volatilize the impurities that cause the fire. This completely removes the fire from silver, and although it does not entirely eliminate the green from gold, it purifies the gold to such an extent that it will readily polish without stripping. It makes the metal homogeneous and increases its malleability and tensil strength. The metal rolls better, or in the case of wire draws better, does not break as readily, since it is tougher, and for spinning or for drawing in a press it is invaluable.

Some difficulty has been experienced in getting old melters to use this new method, says Mr. Finck. "It is hard to teach an old dog new tricks." Some fumes arise which necessitate the use of a hood or the opening of windows or some other means

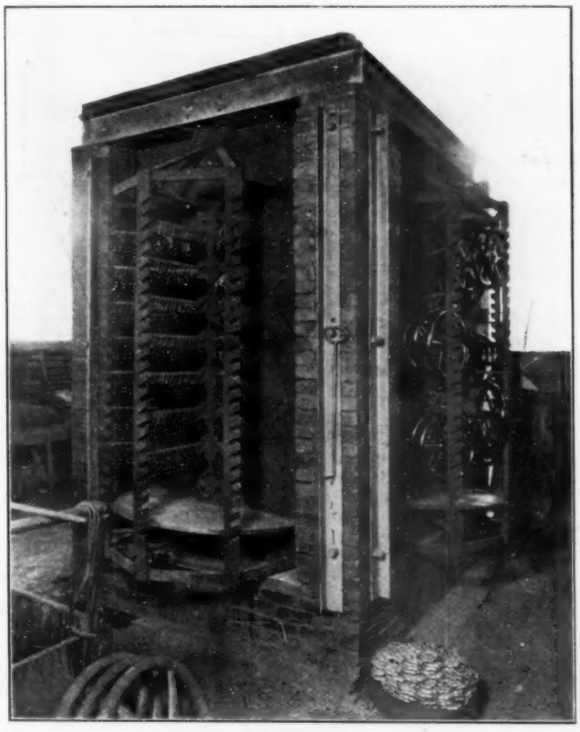
for their escape. There is also a little thought required in its use, as to the right quantity and the proper time for application. Because of these difficulties melters are inclined to reject the new system before giving it a thorough trial. A member of one large firm tested the method himself after it had been reported worthless by the melter, and found that it worked exactly as claimed by Mr. Finck. The melter himself is now using it with great success. Although some manufacturers have met with failure many others have found it invaluable and would not do without it.

Mr. Finck was a manufacturing jeweler for years and is now acting for some of our large concerns in an expert capacity as a production engineer in the mechanical and metallurgical lines, showing how to reduce the cost of manufacturing.

The price is $2 per pound in small quantities. A sample will be sent for $1. As a very small quantity is needed at a time the cost is inconsiderable.

JAPANNING OVEN

A Japanning oven for continuous operation without motive power other than manual was recently developed by Mr. Mason, vice-president and manager of the Nelson Valve Company, in conjunction with Mr. George K. Hooper, of the Hooper-Falkenau Engineering Company, New York City. This oven consists of three reels mounted in a substantial brick casing;



JAPANNING OVEN FOR CONTINUOUS OPERATION.

two of these reels may be seen in the accompanying illustration. They are so located that one-half of each is always inside the oven, while the other half projects beyond the oven casing. Each is built up on a central pipe which is perforated to receive rods or bars which rest at the other end in slotted vertical outer ribs. Upon these bars are hung the articles to be japanned. The reel is divided vertically by a sheet metal diaphragm which serves to close the oven, confining one-half of the reel within the heated space.

To operate this oven, the articles dipped are hung upon the racks of that half of the reel which is outside the oven. The reel is then revolved a half turn, which moves the pieces into the heated space; at the same time the other half of the reel containing the pieces which have been baked, is brought outside the oven. When the baked pieces are removed that half of the reel outside the oven is ready to be filled with freshly dipped pieces as previously described. This operation is continuous with a very low labor cost and a great elasticity, because each type of piece to be baked can be kept in the oven its proper time without affecting the time for any other part.

SPRING MAKING MACHINES

For many years the Baird Machine Company, Oakville, Conn., has built special spring making machines for those concerns who use one or two particular springs for their particular line, such as in firearms, electric switches, etc., in large quantities, and thus desire a machine to make nothing but these particular springs. To meet the incessant demand from spring manufacturers for some standard machines for the making of springs and from the experience gained from building many special spring machines, a standard line of spring making machines was undertaken and brought out with most excellent results, and which are described as follows: These machines are divided into three types, the first being

"BAIRD" SPRING COILING AND CUTTING MACHINES.

These machines can be furnished with either die or roll tools to suit the particular circumstance. Die tools are more easily

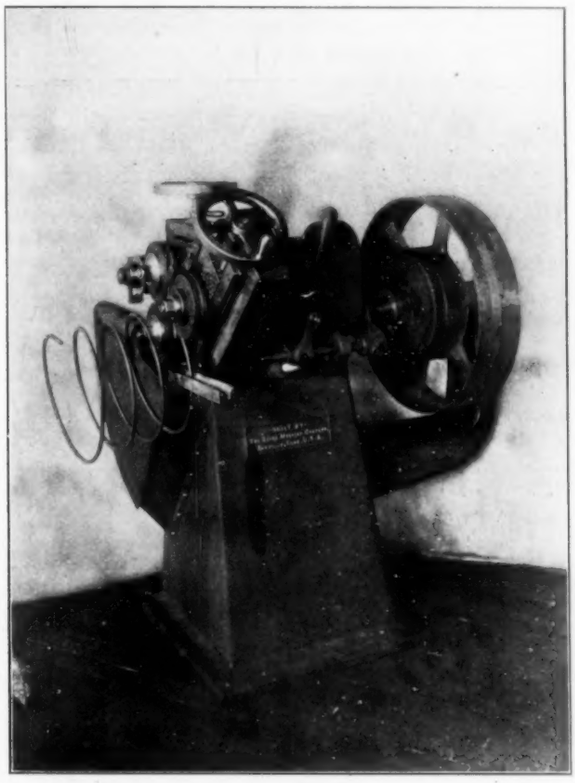


FIG. 1. BAIRD CONTINUOUS SPRING COILING MACHINE.

changed from one size to another, but, of course, are somewhat more expensive to make up in the first place, as they require a separate set of tools practically for each size of spring, but if a concern is using the same spring at intervals, it is cheaper in the end. Roll tools are better for jobbing manufacturers, as with the same rolls on the same diameter of wire, any spring within the capacity of the machine can be made therewith by simply making adjustments, but gauges may be used or tested in other ways to make the different springs. This type of machine, shown in Fig. 1, automatically takes the wire from the coil, feeds a predetermined length, several machines being designed to cover the length, and coils either right or left hand, open or close coiled springs and cuts them off. This machine is capable of receiving attachments for varying the pitch in the spring, so that a spring can be made with both open and closed coils, a very common type being what is known as those with

squared ends, as shown in the illustration. A diameter changing attachment can also be applied, which will make cone or barrel-shaped springs, as shown, and the two attachments together

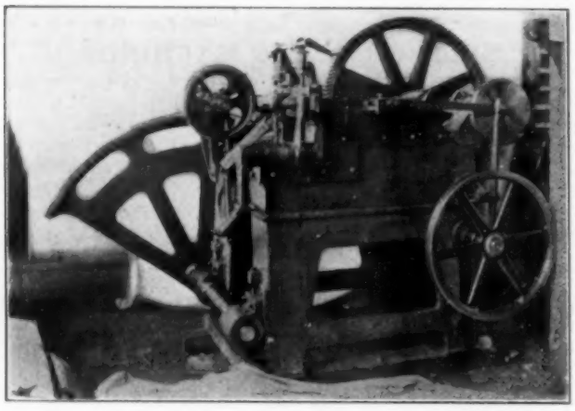


FIG. 2. BAIRD SPRING WINDING AND CUTTING MACHINE.

would make cone or barrel-shaped springs with squared ends, or other such combination. A setting attachment can also be applied to set the spring or take out the initial tension. This machine is made in sizes taking up wire to about 3/16 in. in diameter, and will make springs up to about 2 in. in diameter, and has quite a wide range of adjustment. This type of machine will not make springs with straight ends, this type of spring will require what is known as

"BAIRD" SPRING WINDING AND CUTTING MACHINES.

These machines make springs on an entirely different principle from the coiling machines and, also make open or close, right or left hand and some types of cone springs, but all have straight ends, but the lengths of the ends can be varied within limits, of course, but to suit ordinary conditions.

CONTINUOUS SPRING COILING MACHINES

are about the same as the spring coiling and cutting machines, except that the springs are not cut off, this type of machine being used for making the long springs which consume so much wire that it is impracticable to feed such a length. This machine is also capable of receiving the same attachments for varying the pitch and diameter, or both, as the coiling and cutting machines, with the exception of the setting attachment, so that a long length of spring varying in pitch and diameter for the making of such things as poker handles, etc., can be made and then cut apart into shorter springs by subsequent operations. A type of this coiling machine is shown, Fig. 2, making a spring of large diameter, the rolls being adjustable. Full information as to capacity, etc., can be obtained from the makers, The Baird Machine Company, Oakville, Conn.

ITEMS OF INTEREST TO THE INDIVIDUAL.

George Thompson has accepted a position as foreman plater with The Garth Company, Montreal, Canada.

R. T. Miller has been oppointed acting manager of the Chicago office, 1330 Monadnock Building, of The Pittsburgh Testing Laboratory, Pittsburgh, Pa., to succeed James A. Lister.

C. E. Eggleston, formerly foreman plater for the Biggins-Rodgers Company, Wallingford, Conn., has accepted a similar position with the Landers, Frary & Clark Company, of New Britain, Conn.

Andrew C. Campbell for the past sixteen years secretary, superintendent and chief engineer of the C. J. Manville Machine Company, Waterbury, Conn., has resigned and opened an office as consulting engineer in Waterbury.

T. J. McGrath, inventor of the McGrath Improved Crucible Cover, has resigned from the Peck Brothers Company, of New Haven, Conn., to take charge of the foundry of the E. Stebbins Manufacturing Company, Springfield, Mass.

T. L. Ferrall, for the past fourteen years superintendent of The Rome Manufacturing Company, Rome, N. Y., has severed his connections with that company and is now identified with A. R. Pritchard, of the Pritchard Stamping Company, manufacturers of high grade nickel-plated copper ware, such as kitchen utensils, also brass, copper and plumbers specialties, Rochester, N. Y.

A. D. Sanders, for twenty-three years prominently identified with the plumbing supply trade of Chicago, has sold his interest in the Federal-Huber Company, Chicago, Ill., of which he was the organizer, and has been the active head from the beginning. A. D. Sanders, Jr., who has been closely identified with the Federal-Huber Company for the past seven years, and during the last five years in the capacity of treasurer, withdraws at the same time. The plans of neither of these gentlemen have as yet been announced.

DEATHS

FRANKLIN B. SHUSTER

The death of Franklin B. Shuster, president and treasurer of The F. B. Shuster Company, occured at his home in New Haven, Conn., August 14. He had suffered from bronchial asthma for several years and passed away quietly in his sleep when apparently recovering from an attack.

F. B. SHUSTER.

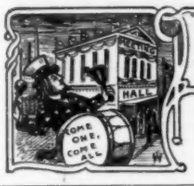
Mr. Shuster was born at New Haven, Conn., May 10, 1866. He learned the trade of a machinist with John Adt and Son, leaving there to become foreman of machine and tool department of the New Haven Clock Company. Later he was for about six years, with the Wilmott and Hobbs Manufacturing Company, now American Tube and Stamping Works, of Bridgeport, Conn., in charge of their machine and tool designing departments. On the death of John Adt in 1895, Mr. Shuster purchased the business, Mr. Adt's son having died some years previous, and in 1898 The F. B. Shuster Company was incorporated.

Mr. Shuster was a genial, courteous gentleman, winning friends wherever he went, and devoted to his home. He was a member of The National Association of Manufacturers, Knights Templar, Shriners, Ancient Order United Workmen, Quinnipiack Club, and many other organizations. He leaves a widow, one son and one daughter.

DR. ISAAC ADAMS

Dr. Isaac Adams, the inventor of nickel plating, died July 24, 1911. Dr. Adams was born in Boston in 1836 and came of a family prominent in the early history of New England, his father being the inventor of the Adams printing press.

After a preliminary course at Chauncey Hall he entered Bowdoin College, where he graduated with honors and then entered the Harvard medical school, after which he took a post-graduate course in the School of Medicine in France. Dr. Adams, early in his career, became interested in electro-chemistry and discovered the vacuum incandescent filament lamp and invented the method of nickel plating. He was a practical business man as well as a theorist and thus was able to push his inventions to a successful conclusion. Dr. Adams became president of the United Nickel Plating Company of Boston, in the services of which company he traveled abroad to establish branches in the various European countries.



Associations and Societies

DIRECTORY OF AND REPORTS OF THE PROCEEDINGS OF THE METAL TRADES ORGANIZATIONS.

AMERICAN BRASS FOUNDERS' ASSOCIATION

President L. W. Olson, Mansfield, Ohio; Secretary and Treasurer, W. M. Corse. All correspondence should be addressed to the Secretary, W. M. Corse, 1155 Sycamore street, Buffalo, N. Y. The objects of the Association are for the educational welfare of the metal industry. Annual convention with the American Foundrymen's Association in a succession of cities as invited. The next convention will be held at Buffalo, N. Y., probably in May, 1912.

Secretary Corse reports that the following were elected to membership: C. R. Minzer, Utica, N. Y.; Victor C. Lassen, East Braintree, Mass.

The committee on papers for the 1912 convention has been announced as follows: F. O. Clements, chief chemist, National Cash Register Company, Dayton, Ohio, chairman; W. R. Webster, Bridgeport Brass Company, Bridgeport, Conn.; W. L. Abate, Standard Sanitary Manufacturing Company, Louisville, Ky.; J. J. Wilson, Cadillac Motor Car Company, Detroit, Mich.; C. F. Harvey, A. Harvey & Sons Manufacturing Company, Detroit, Mich.

INSTITUTE OF METALS

President, Sir Gerard Muntz, Bart.; Treasurer, Professor Turner, M. Sc.; Secretary, G. Shaw Scott. All correspondence should be addressed to the Secretary, G. Shaw Scott, M. Sc., Institute of Metals, Caxton House, Westminster, S. W., London, England. The objects of the Institute are for the educational welfare of the metal industry.

The autumn meeting will be held at Newcastle-on-Tyne, September 20-22.

The following is a list of the Papers that are expected to be submitted:

(1) P. T. Brühl, Esq., M. Sc., on "The Corrosion of Brass With Special Reference to Condenser Tubes."

(2) C. A. Edwards, Esq., M. Sc., on "Further Note on the Nature of Solid Solutions."

(3) Dr. W. M. Guertler on "The Electrical Conductivity and Constitution of Alloys."

(4) J. L. Haughton, Esq., M. Sc., and Professor T. Turner, M. Sc., on "Volume Changes in the Alloys of Copper With Tin."

(5) George Hughes, Esq., on "Non-Ferrous Metals in Railway Work."

(6) Professor H. Louis, M. A., D. Sc., Assoc: R. S. M., on "The Failure of a Brazed Joint."

(7) D. R. Pye, Esq., B. A., on "The Mechanical Properties of Hard Drawn Copper."

(8) Dr. W. Rosenhain, B. A., and S. L. Archbutt, Esq., on "The Alloys of Aluminum and Zinc."

These papers will be published either entire or in abstract in future numbers of THE METAL INDUSTRY.

AMERICAN ELECTROCHEMICAL SOCIETY

President, W. R. Whitney; treasurer, Pedro G. Salome; secretary, Joseph W. Richards. All correspondence should be addressed to the secretary, Joseph W. Richards, Lehigh University, S. Bethlehem, Pa. The objects of the society are to promote the theory and practice of electro-chemistry and electro-metallurgy.

The twentieth general meeting of the society will be held in Toronto, Ontario, from September 21 to 23.

The local committee for this meeting consists of the following: Dr. W. L. Miller, chairman; W. P. Cohoe, Charles Danforth; Saul Dushman, Thomas C. Irving, Jr.; J. A. Kaemmerer, Peter Kirkegaard, J. W. Moffat, L. V. Redman, T. D. Robertson, A. O. Tate, George W. Watts, O. H. Wurster, and any Niagara Falls member as is deemed advisable.

ELECTRO-PLATERS' ASSOCIATION

President, Charles H. Proctor, Arlington, N. J.; Treasurer, H. H. Reama, New York, N. Y.; Corresponding and Financial Secretary, Royal F. Clark; Recording Secretary, Edward Faint. All correspondence should be addressed to the Corresponding Secretary, Royal F. Clark, 246 Fulton avenue, Jersey City, N. J. This is an educational society, the objects of which are to promote the dissemination of knowledge concerning the art of electro-deposition of metals in all its branches. Meets at Grand Opera House Building, 309 W. 23d St., on the fourth Friday of each month, 8 p. m.

The regular meeting of this association was held on August 25, four active members being elected. A Publicity Committee, consisting of Frank P. Davis, chairman; William Schneider, R. H. Sliter, G. H. Buchanan, T. B. Haddow and G. B. Hogaboom, was appointed, and will arrange for an open meeting in October. Several papers and talks then followed, among which were one on "Improving Nickel Deposits by Manipulation," by Thomas B. Haddow; "A Practical Brass Solution," by N. P. Miller; "Non-Sulphidizing Paper for Wrapping Silverware," by C. H. Proctor; "Bright Nickel Solutions," by James Garde and Hugh Baxter, and "Notes on Nickel Solutions," by Messrs Davis and Hogaboom. A general discussion of the papers were then entered into by the members present.

Papers for the next meeting were announced as follows: "Regulating Electric Currents for Depositing Vats," by A. D. Havens; "Electro Tin Plating," by John Painter, and "A Talk On Chemistry," by G. B. Hogaboom.

BUSINESS REPORTS OF THE METAL INDUSTRY CORRESPONDENTS IN THE DIFFERENT INDUSTRIAL CENTERS OF THE WORLD.

ATTLEBORO, MASS.

SEPTEMBER 11, 1911.

While no very big orders have been received as yet, conditions in the jewelry trade are on the mend and a big improvement has been noted in the past month. One of the most accurate barometers of the Attleboro shops' business is the length of the daily shop train from and to Taunton. Last Fall, five cars were the rule; today seven and eight cars make up the train which carries so many of the jewelry workers. Other indications are given in the advertising page of the local paper; the August 29 issue, for instance, contained a column of "Help Wanted" ads. entirely from the jewelers.

Gobin and Company have removed their plant from the old shuttle factory on North Main street to the top floor of the Bushee factory on County street.

The Watson & Newell Company is now occupying the new addition to its factory and extensive improvements are bing made.

Hosmer Keeney and Elton Whiting, of Plainville, have purchased the John Harriot Company, a Boston emblem making firm. The firm has been in existence since 1860.

Though August 1 was the date set by the S. O. Bigney Company in its warning to the trade that improperly marking of plated goods must be stopped, no developments have followed since that date. Jewelers claim that the Vreeland law is defective and will wait with interest the first case that will test the statute.

Ten or more local firms and a half dozen Providence jewelers are planning to exhibit the process of manufacture and the finished jewelry at the New England Exposition in October in Boston. Space has already been secured near the entrance and plans to advertise the trade are bing made.

Attorney John J. Coady is to be head of a new company which is being incorporated to manufacture cut glass by a new process which is said to reduce the time and the breakages in the manufacture. Attempts are bing made to secure factory space in town for the new concern.

The firm of O. M. Draper Estate, North Attleboro, has been reorganized and the O. M. Draper Company has been formed under Rhode Island laws, with a capital stock of $87,500. Since O. M. Draper died in 1900, his executors continued the business with Dr. Edwin Hale, his son-in-law, as manager. The complicated provisions in the trust that his will created have just been fulfilled and made a reorganization possible. Dr. and Mrs. Hale are the only parties to continue their interest in the new firm.

C. W. D.

PROVIDENCE, R. I.

SEPTEMBER 11, 1911.

There has been a slight improvement in metal business of all lines, particularly those connected with the manufacturing jewelry industry, during the past month. Everybody is optimistic and there are great expectations for the coming fall. Ornamental structural work has also experienced a material revival. The Gorham Manufacturing Company has resumed full operations after the annual summer shut down, and every department is now in full swing. The company has on hand several of the largest orders that it has ever been called upon to fill. These include the silver services for three of the Government battleships, the large silverware service for the new Vanderbilt hotel in New York, as well as some notable bronze work. The company now has more than 2,500 employees upon its payrolls.

The C. P. Henry Novelty Company, of Early street, this city, is making a number of alterations and improvements at its plant. Another story is being added to the present building which is 38 feet in width and 160 feet in height. A new roof is being added, steam heat installed and metal skylights, metal sash frames, etc., are being used in the construction.

Providence manufacturing jewelers will be represented by delegates from the New England Manufacturing Jewelers' and Silversmiths' Association and the Manufacturing Jewelers' Board of Trade, at a meeting of jewelers of the country, which is to be held in New York on September 13, for the purpose of forming a protective organization against thieves. The action is the result of many recent robberies of jewelers, and particularly of the bold robbery in New York early in the past month of Jacob Jacoby's store, in which Adolph Stern, a clerk, was shot dead by the robbers, who escaped. President Rothschild, of the New York Jewelers' Board of Trade, says steps will be taken to perfect an organization similar to the existing Bankers' organization. Both of the local organizations received invitations early in the month from President Rothschild to send representatives. George H. Holmes, president of the association, said that the New England Manufacturing Jewelers' and Silversmiths' Association would take the matter up as soon as the vacation period was over and would in all probability send members, and it was stated at the Manufacturing Jewelers' Board of Trade that the organization would undoubtedly have representatives present.

W. H. M.

NEWARK, N. J.

SEPTEMBER 11, 1911.

There was little business being done among the manufacturing jewelers, silversmiths and metal workers during the summer, but now that the hot weather and the vacation period has about passed over, the factories are turning their attention to the fall lines. Those selling to the jobbers are quite busy, as they must have their lines ahead of these firms selling direct to the retail trade. Those selling to the latter are working slowly but are looking for a very good season. It will not be a big one, but on the whole fairly satisfactory.

Frederick & Company is a new firm here to make jewelry at 17 Clinton street. They also do a jobbing business.

Charles W. Park, who recently opened a silver goods factory at 97 Oliver street, making a specialty of German silver mesh bags, has his lines ready, and salesmen will soon go out on the road.

F. Smith, an engraver, who was with Moore & Son, has started a place of business at 13 Franklin street.

The Balbach Smelting and Refining Company have built a new office building at 578 Market street, of brick and concrete, three stories high. A first-class laboratory has been added and other improvements will follow.

Charles C. Wientge and Company, who the past year have been making gold jewelry, have branched out and are making in addition a fine line of silver hollow ware and silver novelties. They make a specialty of order work and have been quite busy.

The American Hame and Bit Company have been making a specialty of a new hame with solid brass tube, instead of the old style brass plated hame. They also do some work in silver hames and bits for very fancy turnouts.

Charles G. Mortimer, who makes dies and experimental work in the Richardson building, is paying some attention to the dies used by manufacturing jewelers.

Martin H. Wiedman has new quarters at 154 Wright street, and is now putting out a general line of jewelry. His shop has been enlarged and has much better facilities than previously.

Day, Clark and Company, late of 32 Marshall street, are in their new factory building of their own on Washington street, and have given up their New York office, all sales to be conducted from the factory.

The K. Bracher, Jr., Manufacturing Company, Belleville, N. J., have bought out the Niagara Oil Stone Company of North Tonawanda, N. Y.

William Bennett, who was superintendent of the jewelry factory of Day, Clark and Company, has started making a line of 10 karat jewelry on his own account at 38 Crawford street.

Sweeden and Company moved from 24 Boudinot street to 23 Marshall street, making gold fountain pens and silver deposit work. They are doing gold plating and coloring, and have taken in partnership Chester Hoagland.

J. R. Cadmus, who has been making 10 and 14 karat gold buttons, lockets and pins, has been succeeded by the Peerless Button Company. Mr. Cadmus has charge of the factory end, and Wolf Brown, the selling end, at 51 Maiden Lane, New York City.

J. W. Rosenbaum, of J. W. Rosenbaum and Company, making plated goods, and who have of late taken up the manufacture of a general line of gold jewelry, has nearly completed his new factory building at Austin and Astor streets. It is five stories in height, has a frontage of 200 feet, of mill construction, brick and stone. It will have first class lighting and power facilities, as well as an artesian well, sprinkler system and three brick enclosed fireproof stairways, fire escapes, etc. Each loft has a burglarproof vault and is thoroughly up-to-date in every way. This firm will move there from their present location at 44 Hunter street, and will greatly enlarge their lines and output. Mr. McRae, of Attleboro, has been engaged to take charge of the factory end. A new equipment will be put in, new machinery and everything necessary to make it a model factory. There will be several lofts to rent to other firms.

The Kaelber-Schmidt Company has been incorporated to manufacture jewelry and novelties, with a capital of $50,000, headed by Friedrich Kaelber, Fred S. Schmidt and Louis Kaelber.

The firm of King and Dreher, manufacturing jewelry at 42 Walnut street, have dissolved partnership, and the business will be continued by Ernest A. Dreher and Ernest A. Dreher, Jr., as E. A. Dreher & Son.

The Reinbold Aluminum Noflux Solder Company have moved their headquarters from 610 Union building to 53 Demarest street, and have been introducing some new lines. One is a preparation to plate aluminum, as well as a solder for the use of the general public.—H. S.

PHILADELPHIA, PA.

SEPTEMBER 11, 1911.

Jobbing lines have been moving slowly this year, but a better fall trade is looked for. The manufacturing jewelers have been easing up somewhat also. General foundry lines and the metal goods manufacturers are preparing for an improvement in business expected.

The American Balance Staff Manufacturing Company of this city has bought the business of the Robinson Manufacturing Company, of Fulton, Ky., which latter plant will be moved to this city at 204 North Ninth street.

All the friends of James C. Brooks, president of the Southwark Foundry Machine Company, mourn his death. He died of heart trouble, 67 years of age, and lived at West Chester. He held the office of president of the concern since 1887. He was connected with several other corporations and was a member of the Union League and the Manufacturers' Club.

The wholesale jewelers and opticians have issued a booklet to advertise this city as a center for the manufacture of jewelry and optical goods, and as a jobbing point.

Steman and Noring, of Baltimore, have started in manufacturing belt buckles, hatpins, cuff buttons, etc., of white metal at 429 North Eutaw street.

The strike is still on at the factory of the Keystone Watch Case Company. The causes of the strike were on two points, the unionizing of jewelers, and the true test of scientific management, which the company were trying to carry out.—H. S.

CLEVELAND, OHIO

SEPTEMBER, 11, 1911.

Business with the metal producing companies of Cleveland is going along in fairly good shape. The factories are all busy and a large amount of stock is being turned out. This is true of both the automobile and the plumbing goods manufacturers.

The auto trade seems to be in a sound, healthy condition in this city according to the chief men interested in the industry. No cheap cars of any consequence are made here and as a result better goods of all kind are being turned out and better profits are being realized. Brass and copper parts replace many sections made of iron on the cheaper cars. The local manufacturers are going into the commercial vehicle trade on a broader scale than ever before and it is believed that this speaks for the permanency of the industry. In a time of business depression people might stop buying fancy priced cars for pleasure trips but they would keep right on purchasing commercial vehicles if it could be shown, as it has been demonstrated, that commercial vehicles can save money.

This has been an unusually successful one in the building field and building records have gone far ahead of former years thus far. The manufacturers of brass and copper plumbing goods are finding themselves booked up with orders for early fall and winter delivery and expect to keep busy well up to the holiday time. They say that the business is expanding on all sides and that more plumbing fixtures are being installed each year. Practically no new houses in cities and few in the country are now built without sanitary conveniences.

One of the interesting incorporations of the past month was Lorain Metal Products Company, with a capital of $60,000. The chief incorporator is F. J. Stock. Lorain is a brisk manufacturing city just west of Cleveland.

Business must be good with the Standard Brass Foundry Company of Cleveland for during the past month it proceeded to increase its capital from $50,000 to $100,000. The plant is running full time and is doing a heavy volume of business according to its officers.

Work is progressing favorably on the completion of the new Cleveland Athletic clubs' building on Euclid avenue. During the past month a contract was let for the furnishing of the electric light fixtures to the Sterling Bronze Company, of New York City. The order is one of the largest and most important let in Cleveland for some time. S. L. McM.

DETROIT, MICH.

SEPTEMBER 11, 1911.

The midsummer conditions still prevail in the brass industry throughout Detroit and the State; business also is about the same as during the previous month. The factories are running full handed, but there is no rush of orders. There still is a fair demand for plumbers' supplies and other manufactured brass products from all parts of the country, but there is good prospects for better conditions as the fall months come on. The automobile factories are running full blast and using large quantities of brass and aluminum. During the last few weeks there seems to be a tendency to discard as much as possible of brass parts and substitute enamel where possible.

"The fashion in automobiles has changed," says S. G. Chapman, local agent of the Hudson Motor Company. "The time was when everybody wanted polished brass and lots of it; and brass is still called for on high priced cars intended to be cared for by high-priced chauffeurs. But the everyday car owner, who looks after his own machine, does not want brass fittings that must be kept bright. He wants black enamel that can be cleaned in a very few minutes by a wet sponge.

"The Hudson Motor Car Company is so thoroughly convinced that this is the feeling that it has fitted out its 1912 model with black enamel lamps, horns and so on. Of course, this is practically a new feature in moderate priced cars, and it costs something extra, but the company is convinced that the owners want it that way."

State Labor Commissioner Perry F. Powers announces that the factory conditions in Detroit are to be investigated, as they appear to be far from what they should be. He says that Detroit has grown so rapidly in recent years that the city is reaping the penalties of its success. "I am making no threats," he says, "as I believe that the factory men in Detroit are law abiding and are not adverse to the strict enforcement of the laws. F. J. H.

TRADE NEWS

TRADE NEWS OF INTEREST DESIRED FROM ALL OF OUR READERS. ADDRESS THE METAL INDUSTRY, 99 JOHN STREET, NEW YORK

ADDITIONAL TRADE NEWS WILL BE FOUND UNDER "CORRESPONDENCE."

The Penna. Etching Company, Bethlehem, Pa., has just been organized to manufacture etched metal name plates, signs, novelties, etc.

Shimer, McGlynn & Company, Nineteenth and Washington streets, Philadelphia, Pa., are now manufacturing Monel metal in sheet, small rod and wire.

The Abbott Ball Company, Hartford, Conn., through F. L. Olcott, sales manager, announces the establishment of a branch office at 96-98 Reade street, New York City.

The Mumford Molding Machine Company, Plainfield, N. J., have opened an office at 75 High street, Boston, Mass., where they will be represented by T. J. Mumford, 2nd.

The Tuttle Plating Company, Hartford, Conn., has been purchased by A. C. Brown, who will specialize in automobile plating in addition to conducting a regular job plating business.

The Ruggles-Coles Engineering Company, New York, has been appointed selling agent for Monel metal castings in the United States and Canada for the Bayonne Casting Company, Bayonne, N. J.

The Adams & Westlake Company, manufacturing railway supplies, car and ship hardware, etc., has purchased property at Twenty-second and Ontario streets, Philadelphia, upon which it is erecting a new plant for its Eastern works.

The Imperial Brass Manufacturing Company, Chicago, Ill., are now building a large factory which they expect to occupy about the first of the year. This will about double their present space, which is too small to take care of their increasing business.

The Bay View Foundry Company, founders in all metals, Sandusky, Ohio, announce that they have recently increased their facilities by the establishment of a pattern shop, and are now prepared to receive orders for thoroughly high-class patterns.

Manufacturers of all kinds of brass foundry equipment and supplies may find it to their interest to send catalogs to Henry D. Stanley, 215 Beechwood avenue, Bridgeport, Conn., who is interested in a new jobbing foundry for which plans are now being prepared.

The Standard Brass Foundry Company, manufacturers of brass, bronze and aluminum castings, Cleveland, Ohio, have opened temporary quarters on Columbus road. The company expects to build a new foundry as soon as they can definitely decide upon a site.

William H. Flavin & Company, 247 Centre street, New York, announces that he has added dynamos and motors to his line of platers' and polishers' supplies and will shortly put one or two representatives out to call on the trade in New York City and the surrounding territory.

The Muncie Brass & Aluminum Castings Company, Muncie, Ind., at present occupying a part of the foundry of Patrick Murphy, report through J. E. Evans, secretary and treasurer, that they have acquired a piece of property and expect to build their own foundry in the near future.

George Godeland, proprietor of the Salem Brass Foundry Company, Salem, Mass., reports that the property on which his foundry is situated will probably be taken over by the Boston & Eastern Railroad for their new elevated line. At present Mr. Godeland is undecided where to move.

The Warner Instrument Company, Beloit, Wis., is erecting a foundry 50 x 75 feet, equipped with a battery of five furnaces, in which high grade yellow castings will be manufactured. About seven brass molders will be employed. At the present time the company has not decided what further equipment will be needed.

The annual report of the National Enameling and Stamping Company of New York, for the year ended June 30, shows gross profits of $1,718,671. The total income of the company was $44,838 over that of the previous year. The surplus for the year was $171,156, while the total surplus and reserve at the close of the year was $3,278,301.

The American Emery Wheel Works, Providence, R. I., have begun the erection of a building for the storage of raw and finished material, the ground floor of which will be used as an addition to their molding room. The building will be 45 x 95 feet, one half having a basement and two stories, the other half having an additional floor.

The Tallman Brass & Metal Company, Hamilton, Ontario, announce that owing to the increase in business they are erecting an addition to their foundry and also building a large addition to their finishing department. They are carrying a large stock of brass rod, sheet, tubing and wire, and report being very busy in their white metal department.

The Standard Aluminum Company, Two Rivers, Wis., report, through Adolph Kummerow, secretary and treasurer, that their new three-story, fireproof factory is well under way, and they expect to occupy the same by the first of the year. The company have contracted for a great amount of machinery which will enable them to triple their output.

The Artistic Bronze Company, manufacturers of cabinet and builders' hardware, South Norwalk, Conn., through their engineer, H. B. Close, Bridgeport, Conn., is in the market for electric motors, oil or gas engine and electric generator, and will be especially interested in having information about individually driven buffing and polishing machines.

The Yale & Towne Manufacturing Company, manufacturers of "Yale" products, Stamford, Conn., are now working on the plans for a plant to be located at St. Catherine, Ontario, to be known as the Canadian Yale & Towne, Ltd., where they will make such lines of their products as are used in Canada. It is hoped that the actual work on this plant will commence within the next two months.

The Globe Machine & Stamping Company, Cleveland, Ohio, have completed one building of their new plant. This is a one-story steel automobile box factory 100 by 165 feet. Work has been started on the main building, which will be two stories, 116 by 250 feet. The two buildings will provide about 55,000 square feet of floor space and the machinery will be driven by motors in the group plan.

The Electro Bronze Company, Arlington, N. J., has recently been formed for the purpose of manufacturing cast metal novelties of every description, antimonial lead castings for the portable chandelier and metal goods trades and to carry on an electroplating and finishing business in all its branches. This firm is composed of Charles H. Proctor, the well-known plating expert, who will look after the factory end of the business and Erving W. Vidaud, who will take charge of the selling end.

The Tube Bending Machine Company, Newark, N. J., has been reorganized as the Tube Bending and Polishing Machine Company. New interests have been taken into the firm and the

factory is being removed to Baltimore, Md. This concern manufactures well-known machines for automatically polishing tubing and has also several other departments, including tube bending machinery, and a process of making metal goods by means of electrodeposition.

The Platinum Metals Company, at 17 and 19 Ninth street, Brooklyn, N. Y., are manufacturing a complete line of platinum salts for all purposes, and invite users of these salts to correspond with them. They claim that their products are exceptionally pure and their prices as low as any. They sell platinum chloride, either dry or in solution, in any quantity, and deal directly with the consumer. This concern also buys or refines platinum scrap or waste of any kind. They also make a specialty of assays of platinum.

The Alliance Brass & Bronze Company, manufacturers of castings of all kinds except iron and steel, Alliance, Ohio, have begun the erection of their new plant. The first building, 100 x 40 feet, will be used as a casting shop, where from thirty to forty men will be employed. The office building and pattern shop will be erected later. The output of the company will be greatly increased by the new plant. The officers of the company are: President, C. J. Rath; vice-president and treasurer, John Bracher; secretary, C. W. Smith.

The Republic Metalware Company, Buffalo, N. Y., are at present erecting a one-story building, 50 x 200 feet, to be used as an extension to their enamelling department. Plans have been completed for the erection of another building, which will eventually be seven stories in height, only three stories of which, however, will be erected immediately. This building will be used as a machine shop for similar purposes. James F. Foster, vice-president and treasurer, says: "These buildings were rendered necessary by the amount of work the plant is doing."

The Perfection Spring Company, manufacturers of automobile springs, Cleveland, Ohio, have acquired the plant of the Standard Brass Foundry Company, and will remodel and enlarge it. The company report, through P. A. Connelly, secretary, that they will operate the new plant in addition to their present one, and when the changes have been made they expect to place on the market a new automobile motor. Twelve new furnaces and considerable spring manufacturing machinery will be installed. The capital stock of the company has been increased from $200,000 to $500,000.

The Gun Metal Finish Company has recently been formed at Decatur, Ill., with J. D. Jenison, formerly foreman plater and chemist of the Faries Manufacturing Company of Decatur, at the head. This new company will manufacture a gun-metal finish for lamps and brass parts of automobiles, which has been perfected by Mr. Jenison. This is a chemical, the action of which when applied to brass causes a black scale to form that resists the heat and is very durable. It will not crack nor peel like paint or enamel when heated, but on the contrary heat causes this finish to become exceedingly hard. The Beckley-Ralston Company of Chicago will be the exclusive distributors.

The Ideal Furnace Company, Chester, Pa., have recently placed on the market what they term their Baby Ideal, which is a furnace built to accommodate a No. 125 crucible, and if operated correctly will produce eight heats per day. The following firms have installed this furnace: Thomas R. Ober Company, Philadelphia, Pa.; The Crown Foundry Company, Jackson, Ohio; A. P. Smith & Company, Fischer-Sweeney Company, Hoboken, N. J., and The Gamon Motor Company, Newark, N. J. The installation is simple—just roll it in and start the fire. No connections to make, only a small fan. The company will be glad to permit responsible parties to try out the furnace for thirty days.

Proposals will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until 10 o'clock a. m., October 3, 1911, and publicly opened immediately thereafter, to furnish at the navy yard, Mare Island, Cal., a quantity of naval supplies as follows: Schedule 3909—Aluminum, bronzing, 1,200 pounds; bronze, rod naval, 2,800 pounds; lead, sheet, 6,000 pounds. Schedule 3911—Brass, rod, 6,200 pounds; copper, ord, 2,295 pounds; monel metal, 1,150 pounds; zinc boiler plates, 60,000 pounds. Applications for proposals should designate the schedules desired by number. Blank proposals will be furnished upon application to the navy pay office, San Francisco, Cal., or to the Bureau. T. J. Cowie, paymaster-general, U. S. N.

The Peck, Stow & Wilcox Company, manufacturers of mechanics' hand tools, tinsmiths' machines, builders' and general hardware, Southington, Conn., voted at the annual meeting to increase the capital stock of the company by $250,000, in order to provide funds for the erection and equipment of the new buildings, as reported in the July issue of THE METAL INDUSTRY. It is the plan of the company to concentrate the business at the main plant at Southington, and the new buildings will be used principally to take care of the manufacturing now done at the branch factories at East Berlin and Plantsville, Conn. The following officers were elected at the annual meeting: President, L. H. Treadway; vice-president, M. H. Holcomb; secretary, L. E. Fitchorn; treasurer, E. N. Walkley; directors, L. H. Treadway, M. H. Holcomb, L. E. Fitchorn, W. R. Walkley, M. B. Wilcox, S. H. Wilcox, A. R. Treadway, F. L. Wilcox and F. C. Sumner.

Owing to the fact that their business has quadrupled during the past five years, the Brown Instrument Company, Philadelphia, Pa., will move to larger quarters. An office will be retained at the old location, 311 Walnut street, where they have been for over fifty years, but the laboratory will be moved to Ninth and Montgomery streets, in connection with that of the Keystone Electrical Instrument Company, manufacturers of voltmeters and ammeters. Edward Brown, who was the first manufacturer of pyrometers in the United States, was the founder of the business, which bore his name up to a few years ago, when the Brown Instrument Company was incorporated, of which Richard P. Brown is president. The connection with the Keystone Company was made owing to the fact that electrical instruments play an important part in the construction of pyrometers. Under the new arrangement both companies will manufacture pyrometers, thermometers, speed indicators, draft and recording gauges, and colt and ammeters, and are in a position to manufacture or repair practically any type of instrument. The branch offices of the Brown Company at Pittsburgh and Chicago will be continued.

The American agency for the Bates and Peard Annealing Furnace has been placed in the hands of Hartley, Spalckhaven & Fay, 296 Broadway, New York, by the Bates and Peard Company, Huyton, Liverpool, England, who control the patents covering the furnace. For many years this concern was represented in the United States by C. M. Dally, whose death occurred recently as noted in THE METAL INDUSTRY. The new agents for the Bates and Peard furnace purpose pushing it aggressively. It is adapted for annealing almost all kinds of material, both large and small. At the offices of Hartley, Spalckhaven & Fay may be seen photographs of many important installations, including the Royal Mint, England; the French Mint; the Calcutta Mint; the Philadelphia Mint; the Australian Mint; the Japanese Mint and H. M. Indian Arsenal. At the Detroit Copper and Brass Rolling Mills, Detroit, Mich., is a machine for annealing wire, which has a capacity of forty-three tons in twenty-four hours. Another wire annealing machine will be found at the works of the Furnkawa Copper Company, Japan; while machines for wire coils have been installed, one by the Societa Ligure Ramifera, Genoa, Italy, with a capacity of four and one-half tons in eight hours, two by The Allegemeine Elektricitäts Gesellschaft, Berlin, Germany, and in many other works. The Societe Anoyme des Usines a Cuivre et a Zinc, St. Petersburg, Russia, has a machine for annealing sheets four feet wide, and H. Hipkiss & Company, England, have two for annealing brass stampings. A small size of the Bates & Peard furnace, called jewelers type, is manufactured and has been installed in a large number of prominent jewelry factories, among which are Kallman & Jourdan, Pforzheim, oil-fired; F. Kammerer, Pforzheim, gas-fired; Messrs. Kreidler, Stuttgart, Germany, coal-fired. These are only a few instances cited to show the wide application of the Bates & Peard furnace. Any concern interested in annealing articles of copper, brass, etc., in any form can obtain full particulars regarding these various furnaces by applying to the agents mentioned above.

FOREIGN TRADE OPPORTUNITIES

No. 7199.—Zinc and Lead.—A report from an American consul in an European country states that a long-established firm in his district that is a regular exporter to the United States, and a producer of zinc, second fusion, would be pleased to sell American zinc, first fusion, as well as lead.

No. 7149.—Polished Sheet Copper.—An American consular officer in England forwards the name of a person in his district who wishes to enter into communication with manufacturers of polished sheet copper, such as is used by photo-process engravers. The applicant has had many years' experience dealing in printing and engraving materials, and is personally known to the largest users of such goods in that country.

No. 7238.—Metals and Iron and Steel Goods.—The Bureau of Manufactures is in receipt of a communication from a business man in Russia stating that he would like to communicate with firms in the United States producing steel, lead, colophany, all kinds of iron tubes, iron fittings, brass, bronze, and cast-iron armature and balances. He desires to hear only from firms seeking export trade, and would like to receive catalogues, price lists, discounts, samples, and other particulars.

(Addresses may be obtained from the Bureau of Manufactures, Washington, D. C., by referring to file numbers.)

CHANGE OF FIRM

Roulet & Son, manufacturing jewelers, 319 Superior street, Toledo, Ohio, announce that they have acquired the business formerly conducted by Hause & Roulet, also all of the tools, machinery, dies, etc., formerly owned by W. A. Rankin, and have moved and consolidated both plants at the above address, where they are fully equipped to do everything pertaining to the manufacture and repairing of jewelry.

The Electric City Foundry Company, manufacturers of iron, brass and aluminum castings, Schenectady, N. Y., has been incorporated to take over the plant formerly operated by the Mohawk Foundry Company. The new company have started operations and are fairly well supplied with orders, and expect that shortly they will be in the market for material and supplies. The officers of the company are: President, A. F. Shaffer; vice-president and treasurer, C. F. Buhrmaster; secretary and general manager, E. J. Morrow.

The name of The Ontario Brass Rolling Mills, Ltd., manufacturers of brass, copper, bronze and German silver, New Toronto, Ontario, has been changed to Brown's Copper & Brass Rolling Mills, Ltd. There was no change in the personnel of the company, as the change was made solely to avoid the confusion which has arisen owing to the number of industries with "Ontario" in the front of their names. The company reports through J. F. Brown, president, that their mill has been very successful and at present is running night and day to keep in touch with their orders.

REMOVALS

The Reinhold "noflux" Aluminum Solder Company is now established in its new factory at 10 Hobson street, Newark, N. J.

The Electrolytic Art Metal Company, manufacturers of silver deposit ware, Trenton, N. J., has moved its plant from 1294 Parker avenue to Beatty and Adeline streets.

The Coe Brass Manufacturing Company, manufacturers of brass, copper, bronze and German silver in sheets, plates, rolls, wire, rods, tubes, etc., Torrington, Conn., have removed their laboratory from Torrington to Waterbury, Conn.

INCREASE OF CAPITAL STOCK

The Standard Brass Foundry Company, Cleveland, Ohio, has increased its capital stock from $50,000 to $100,000.

The Standard Aluminum Company, manufacturers of pure aluminum ware and novelties, Two Rivers, Wis., recently increased its capital stock from $15,000 to $50,000.

INCORPORATIONS

Business organizations incorporated recently. In addressing them it is advisable to include also the names of the incorporators and their residence. Particulars of additional incorporations may frequently be found in the "Correspondence" columns.

The Phoenix Die Casting Company, Buffalo, N. Y. Capital stock, $15,000. To manufacture dies, die castings, etc. President, Henry Bechter.

Elgin Silver Plate Company, Elgin, Ill. Capital stock, $100,000. Incorporators: J. M. Blackburn, G. W. Blackburn and R. W. Crocker, all of Elgin.

New England Zinc Corporation, Stamford, Conn. Capital stock, $100,000. Incorporators: R. M. Andrews, Fred C. Parsons and John E. Martin, all of Stamford.

Elyria Brass, Iron & Steel Company, Elyria, Ohio. Capital stock, $50,000. To manufacture brass goods and plumbing supplies. The incorporators include J. V. Kennedy, of Cleveland.

Royal Brass Manufacturing Company, Bridgeport, Conn. Capital stock, $1,000. Incorporators: George B. Hedges, Edmund W. Van Voorhis and Arleigh Pelham, all of Bridgeport.

Russell Bronze Company, Chicago, Ill. Capital stock, $20,000. To manufacture ornamental bronze fixtures. Incorporators: M. S. P. Thomas, W. S. Underwood and R. Swanston, all of Chicago.

The Langer Auto Castings & Foundry Company, Chicago. To manufacture iron, brass and aluminum castings. Incorporators: Conrad P. J. Langer, Joseph Van Craebebroech, and John Holland, all of Chicago.

The McDonald Bros. Machine & Foundry Company, Gage, Okla. Capital stock, $7,000. To manufacture gray iron, brass and aluminum castings. Incorporators: W. H. McDonald, J. F. McDonald, I. O. McCullough, and R. R. Sherwood, all of Gage.

PRINTED MATTER

Coal, Oil and Boiler Water.—The Harris Laboratory, chemical engineers, New York, have published a pamphlet relating to the testing of coal, oil and water, in which they give a concise account of the services that they are ready to render industrial plants in connection with the power question.

Gear Hobber.—A comprehensive circular No. 805 has been issued by the Adams Company, manufacturers of molding machines, milling machines, snap flasks, etc., Dubuque, Iowa. This circular contains eighteen pages and is devoted entirely to the Farwell Gear Hobber. Copies will be sent upon request.

Casting Alloys.—The Lumen Bearing Company, Buffalo, N. Y., have issued a special booklet describing a number of their high grade alloys used in the high pressure air valves, hydraulic work, superheated steam high pressure and severe work, such as gear blanks, worms, etc. Copies of this booklet will be sent upon request.

Automatic Specialties: John Acton, 118 John street, Brooklyn, gives a full description of modern automatic steam, water and air vacuum specialties manufactured by him. These specialties include the Acton high-pressure reducing valve vacuum systems for heating, Corliss balanced valve, Acton relief valve and the Acton automatic pump receiver and regulator, etc.

Fittings and Unions: The Kelly & Jones Company, manufacturers of unions and fittings of all kinds, Greensburg, Pa., have issued a small booklet giving complete specifications and illustrations of their brass fittings and unions. These goods are

made in the new brass department of the company, which is equipped with the most modern machinery obtainable and satisfaction is guaranteed in the product.

AUTOMATIC STOP VALVE: Bulletin No. 29, issued by the Rockwell Furnace Company, New York, gives a full description of the Lalor automatic stop valve used for automatically stopping the supply of oil in the case of a breakage in the oil lines or abnormal flow of fuel to the burners. The circular also gives illustrations, showing how the master stop valve is applied to pumping gravity or pressure systems. Copies of the bulletin may be obtained upon request.

POLISHING MACHINES: A small catalog has been issued by Smith & Richardson, manufacturers of polishing machines, Attleboro, Mass., describing and illustrating their polishing tank or tubbing machine and cutting down or dry burnishing machine. In addition to the above mentioned machines this firm also manufactures machine or hand made chain, woven-wire chain and safety fob fasteners for the manufacturing jeweler. Copies of this catalog will be sent upon request.

ALUMINUM WARE.—The Buckeye Aluminum Company, manufacturers of aluminum goods, Doylestown, Ohio, have issued illustrated catalog and price list "E," giving complete descriptions of their "real solid" aluminum utensils. The catalog contains an instructive article on the use of aluminum cooking utensils by Helen L. Johnson, an expert on the subject, and following this article is a complete illustrated price list of all the numerous styles of utensils made by them. Copies on request.

PATTERN SHOP AND FOUNDRY SUPPLIES: The Cleveland Galvanizing Works Company, manufacturers of foundry and pattern shop supplies, Cleveland, Ohio, have issued a 32-page catalog describing and illustrating their extensive line of pattern letters. These letters are manufactured in stock sizes in white metal and brass, and instructions are given in the catalog for measuring and fastening the letters to patterns. The catalog also covers an extensive line of brass and wood dowels, iron pinch dogs, rapping plates, chaplets of all kinds, flasks, riddles and other goods manufactured by the firm.

MINERAL CLEANER: The Electric Smelting & Aluminum Company, Lockport, N. Y., make some very superior claims for their mineral cleaner used in preparing metal goods for plating. They say in a little booklet just issued that it contains no fat or oil, will not injure the hands, polished work is not tarnished and buffing dirt is removed with little or no trouble. This cleaner is put up in barrels of 250 pounds and kegs of 100 pounds each, and the price is four cents per pound f. o. b. Lockport. An absolute guarantee is given with the material that if it does not substantiate the claims made for it there will be no charge.

PRESSES: The Standard Machinery Company, manufacturers of presses of all kinds, drop hammers, rolling mills, etc., Providence, R. I., have issued their Standard catalog for 1912. This catalog comprises 131 pages and is 9 by 6 inches in size, and gives a complete description and specification of the extensive line of presses manufactured by the company. This line of presses includes: Single and double acting power presses, both plain and geared; also transfer, reducing, coining and double crank presses and various applications that special presses are used for. It also covers a line of foot and screw presses. Copies of the catalog will be mailed upon request.

CARBOY ROCKERS. The "Nonesuch" patent stop carboy rocker is fully illlustrated and described in a folder issued by Rockhill & Vietor, sole distributors, 114 John street, New York. This apparatus is a radical departure from any carboy rocker heretofore put on the market. It can be attached to the carboy in a few seconds and is provided with a vent tube which is inserted into the carboy and which prevents the contents of the carboy from splashing or spattering. One of the great advantages of the carboy is the patent stop, which permits the carboy to remain, when not in use, in such a position that it is an extremely simple matter to pour from it. This rocker is a simple, strong and durable device and is sold at a very low price.

CATALOGUE EXHIBIT

An exhibition of every kind of catalogue may be seen at THE METAL INDUSTRY office, 99 John street, New York. THE METAL INDUSTRY is prepared to do all of the work necessary for the making of catalogues, pamphlets, circulars and other printed matter. Estimates will be furnished for writing descriptions, making engravings, printing, binding, for the entire job from beginning to end or any part of it.

AD NEWS

"The Facts About Optimus Platers" is the heading of Munning-Loeb Company's ad. in this issue. Their catalogue "M" gives full particulars.

Smith & Richardson, Attleboro, Mass., show some large cuts of the Imperial polishing and burnishing machine, and state that over 500 of them are now in use, and that the cost of operating one is only two cents a week.

The manufacturers' Brush Company, Cleveland, Ohio, advertise the advance scratch wheel and invite users of such goods to write for description and quotations. This company makes a specialty of foundry and platers' brushes.

The Platinum Metals Company, 17 and 19 South Ninth street, Brooklyn, N. Y., are manufacturers of platinum salts and solutions. They are also large buyers and users of platinum scrap and materials containing platinum in any form.

Leiman Brothers, 62J John street, New York, again illustrate their well-known sand blasts and polishing dust collectors. This firm also makes the well-known Leiman blower, and furnishes jewelers' and polishers' equipment, etc., of all kinds.

Fitz Dana & Company, Boston, Mass., whose ad. appears on the back cover, and their New York House, Fitz, Dana and Brown, are among the largest dealers in metals in America, and are prepared to supply practically any kind of metals required.

E. A. Flavell, Box 201, New Britain, Conn., who controls "Coslettizing," the new English rust-proofing process, in this country, invites correspondence from those interested in the prevention of rust. His advertisement may be found on another page.

Hartley, Spalckhaven & Fay, 296 Broadway, New York, are the newly-appointed agents in the United States for the famous Bates and Peard annealing furnace. Their advertisement on another page mentions the large range of work which can be economically annealed in this furnace.

The United Aluminum Ingot Company, 42 Broadway, New York, have taken space in which to advertise their aluminum ingots and alloys. They solicit large or small orders, guarantee the percentage of aluminum in their ingots, and promise strict attention to all orders and prompt delivery.

The Michigan Copper and Brass Company, Detroit, Mich., have begun to advertise their "Wolverine" brass in sheets and rolls, rods, wire and tubing; low brass, bronze and oreide in sheets and rolls, rods, wire and tubing; and copper in sheets and rolls. They point out the fact that using only the best grades of Lake copper, their products are of the highest grade.

The Bassite Smelting and Manufacturing Company, Cincinnati and Milford, Ohio, make a strong statement in their advertisement regarding the attitude of foundrymen toward new things. They point out how Bassite met with many difficulties, and assert that it has now overcome so many prejudices in so many minds that no foundryman should fail to try it out.

The Electro-Bronze Company, Arlington, N. J., recently organized by Charles H. Proctor and Erving W. Vidaud, has a card in this issue calling attention to the special lines they are prepared to quote prices on, which include manufacturing cast metal novelties of every description, electroplating and finishing in all its branches, antimonial lead castings for the portable chandelier and metal goods trade.

METAL MARKET REVIEW

NEW YORK, September 11, 1911.

COPPER.

The month of August has been devoid of any startling developments in the copper market, the most important feature to note has been the remarkable steadiness of prices in face of a very dull consumptive demand.

The exports during the month were heavy, and probably saved the market from any violent fluctuation, the total exports so far reported were 27,893 tons, against 27,976 tons last year. Total exports since January 1, 1911 were 222,626 tons, against 180,218 tons during the same period in 1910.

Prices today are about ⅛ cent lower than a month ago, trading has been very dull and the activity noted a few weeks ago has not been as prominent during the latter part of August. Producers claim to be well sold up and have not been pressing copper on the market; what little cutting has been done has come from second hands, and stocks today from these sources have been pretty well eliminated, so that prices are likely to firm up on any signs of a buying movement.

Lake copper today is quotable at 12⅝ cents per pound, against 12¾ cents a month ago, electrolytic at 12½ cents, and casting brands at 12⅜ cents.

The London market has held very steady, considering the disturbing elements through the labor strikes and the more or less unsettling Morocco incident, it is evident at present writing that Germany is getting ready to save her face and get out.

All reports from Europe confirm the enormous business activity abroad, and the outlook is bright for a continued demand for copper from this side.

TIN.

The local tin market has been up against a very extraordinary combination of events altogether beyond any one's control. On account of the strike abroad shipments have been held up and consumers had to get along the best way they could—prices have been very erratic and fluctuations have been very violent. Today delayed shipments are coming along and the market is getting down to more or less normal conditions.

Consumption has been very good, amounting to 3,800 tons, leaving a total visible supply of 16,619 tons, against 16,707 tons a month ago.

Prices today for spot tin 5 ten-ton lots are quotable at 41.75 cents, while September, October deliveries can be secured at from 41¼ to 41.

LEAD.

The market has held very firm and the open market price has been from 5 to 10 points above the Trust price at the close. The market is a shade easier at 4.55 New York for carload lots, and the St. Louis market is steady at 4⅓, f. o. b., East St. Louis.

The foreign market is firm at £14 6s. 3d., an advance of about 10s. from the opening.

SPELTER.

The spelter market has been held very steady from 5.85 to 6 cents for carload lots New York delivery at the close. In St. Louis the market is quotable at 5.80 to 5.85.

The foreign combination holds well together and prices are close to £28, and at this price consumers over there seem to think it a favor to be able to get any metal even at that price.

ALUMINUM.

There has been no change in aluminum, prompt or future delivery is quotable at from 19¾ to 20 cents, according to quantity—for ingots 98-99 per cent. pure, for small lots 20¼ to 20½ is asked.

ANTIMONY.

The antimony market is a shade easier; Cookson has come down ¼ cent per pound to 8⅜ cents. Halletts is quotable at around 7¾, and Chinese at 7⅛ cent cents.

SILVER.

The silver market has been very dull, and prices show hardly any change, opening at 52⅛ cents and closing at 52¼. In London prices have fluctuated within ¼d. per ounce during the entire month opening at 24 1/16d., and closing at 24⅛d.

QUICKSILVER.

The market has shown a slightly easier tendency and the wholesale quotation is $47.50 against $50, and $48 a month ago. Retail lots are quotable at around $48 to $48.50 per flask.

PLATINUM.

The market for platinum is rather firmer and prices are about $2 per ounce higher. Hard (10 per cent.) is quotable at $46.50, and the ordinary refined at $44 per ounce. Iridium is quoted at $65 per ounce.

SHEET METALS.

Sheet copper is quotable at 16½ cents, base with wire at 13½ to 13¾ base. The brass manufacturers' list price stands at 13⅜ base, but no one has to pay this price today.

OLD METALS.

There is a fair business doing, the principal support to the market is the export demand, and this keeps the market more or less alive.—J. J. A.

COPPER PRODUCTION

(Issued by the Copper Producers' Association.)

		September 8, 1911.
Stocks of marketable copper of all kinds on hand at all points in the United States, August 1, 1911....		137,738,858
Production of marketable copper in the United States from all domestic and foreign sources during August, 1911		125,493,667
		263,232,525
Deliveries:		
For domestic consumption	59,935,364	
For export	69,855,660	
		129,791,024
Stocks of marketable copper of all kinds on hand at all points in the United States, September 1, 1911		133,441,501
Stocks decreased during the month of August.....		4,297,357

AUGUST MOVEMENTS IN METALS

COPPER.	Highest.	Lowest.	Average.
Lake	12.75	12.60	12.65
Electrolytic	12.70	12.50	12.60
Casting	12.55	12.35	12.45
TIN	46.30	41.50	43.55
LEAD	4.60	4.50	4.55
SPELTER	6.10	5.80	5.95
ANTIMONY (Hallett's).....	8.00	7.75	7.90
SILVER	.52⅜	.52	52.15

WATERBURY AVERAGE

The average price of lake copper per pound as determined monthly at Waterbury, Conn.:

1910—Average for year 13.13½. 1911—January, 12⅞; February, 12¾; March, 12½; April, 12½; May, 12⅜; June, 12⅝; July, 12¾; August, 12¾.

DAILY METAL PRICES

We have made arrangements with the New York Metal Exchange by which we can furnish our readers with the Official Daily Market Report of the Exchange and a year's subscription to THE METAL INDUSTRY for the sum of $10. The price of the reports alone is $10. Sample copies furnished for the asking. We can furnish daily telegraphic reports of metal prices. Address THE METAL INDUSTRY, 99 John street, New York.

Metal Prices, September 11, 1911

NEW METALS.	Price per lb. Cents.
COPPER—PIG, BAR AND INGOT AND OLD COPPER. Duty Free, Manufactured 2½c. per lb.	
Lake, carload lots	12.65
Electrolytic, carload lots	12.50
Casting, carload lots	12.35
TIN—Duty Free.	
Straits of Malacca, carload lots	41.75
LEAD—Duty Pigs, Bars and Old, 2½c. per lb.; pipe and sheets, 2⅜c. per lb.	
Pig lead, carload lots	4.55
SPELTER—Duty 1⅜c. per lb. Sheets, 1⅝c. per lb.	
Western carload lots	6.00
ALUMINUM—Duty Crude, 7c. per lb. Plates, sheets, bars and rods, 11c. per lb.	
Small lots	28.00
100 lb. lots	25.00
Ton lots	20.00
ANTIMONY—Duty 1½c. per lb.	
Cookson's, cask lots, nominal	8.35
Hallett's cask lots	7.75
Chinese	7.20
Hungarian grade	7.20
NICKEL—Duty Ingot, 6c. per lb. Sheet, strips and wire 35 per cent. ad valorem.	
Shot, Plaquettes, Ingots, Blocks according to quantity	.43 to .60
MANGANESE METAL—Duty 20 per cent.	.90
MAGNESIUM METAL—Duty 3 cents per pound and 25 per cent. ad valorem (100 lb. lots)	1.85
BISMUTH—Duty free	2.10
CADMIUM—Duty free	.85
CHROMIUM METAL—Duty 25 per cent. ad val.	.98
	Price per oz.
GOLD—Duty free	$20.67
SILVER—Duty free	.52¼
PLATINUM—Duty free	45.00
QUICKSILVER—Duty 7c. per lb. Price per pound	.70

Dealers' Buying Prices. Cents per lb.	OLD METALS.	Dealers' Selling Prices. Cents per lb.
10.75 to 11.00	Heavy Cut Copper	12.00 to 12.25
10.50 to 10.75	Copper Wire	11.50 to 11.75
9.75 to 10.00	Light Copper	10.50 to 10.75
9.25 to 9.50	Heavy Mach. Comp	10.50 to 10.75
7.00 to 7.25	Heavy Brass	8.00 to 8.25
5.50 to 5.75	Light Brass	6.75 to 7.00
7.00 to 7.25	No. 1 Yellow Brass Turnings	7.75 to 8.00
8.00 to 8.25	No. 1 Comp. Turnings	8.75 to 9.00
3.90 to 4.00	Heavy Lead	—— to 4.25
3.75 to 3.90	Zinc Scrap	—— to 4.25
5.00 to 5.50	Scrap Aluminum, turnings	6.00 to 7.50
10.00 to 12.00	Scrap Aluminum, cast, alloyed	11.00 to 13.00
14.00 to 15.00	Scrap Aluminum, sheet (new)	16.00 to 17.50
23.00 to 24.00	No. 1 Pewter	25.00 to 26.00
20.00 to 23.00	Old Nickel	23.00 to 26.00

INGOT METALS.	Price per lb. Cents.
Silicon Copper, 10% to 20%..according to quantity	28 to 35
Silicon Copper, 30% guaranteed " "	38
Phosphor Copper, 5% " "	19 to 21
Phosphor Copper, 10% to 15%, guaranteed " "	28 to 30
Manganese Copper, 30% " "	30 to 35
Phosphor Tin " "	34 to 36
Brass Ingot, Yellow " "	8½ to 9½
Brass Ingot, Red " "	11 to 12½
Bronze Ingot " "	10 to 11
Manganese Bronze " "	17 to 19
Phosphor Bronze " "	13 to 16
Casting Aluminum Alloys " "	29 to 35
PHOSPHORUS—Duty 18c. per lb. According to quantity	30 to 35

PRICES OF SHEET COPPER.

BASE PRICE, 16.50 Cents per Lb. Net.

PRICES MENTIONED BELOW ARE FOR QUANTITIES OF 100 LBS. AND OVER.

SIZE OF SHEETS.		64 oz. and over 50 lb. sheet 30 x 60 and heavier.	32 oz. to 64 oz. 25 to 50 lbs. sheet 30 x 60.	24 oz. to 32 oz. 18¾ to 25 lb. sheet 30 x 60.	16 oz. to 24 oz. 12½ to 18¾ lb. sheet 30 x 60.	14 oz. and 15 oz. 11 to 12½ lb. sheet 30 x 60.	12 oz. and 13 oz. 9¼ to 11 lb. sheet 30 x 60.	10 oz. and 11 oz. 7¾ to 9¼ lb. sheet 30 x 60.	8 oz. and 9 oz. 6¼ to 7¾ lb. sheet 30 x 60.	Lighter than 8 oz.
		Cents Per Pound Over Base Price for Soft Copper.								
Not wider than 30 ins.	Not longer than 72 inches.	Base	Base	Base	Base	1	2	3	6	9
	Longer than 72 inches. Not longer than 96 inches.	"	"	"	"	1	3	6	9	
	Longer than 96 inches.	"	"	"	"	2	6			
Wider than 30 ins. but not wider than 36 inches.	Not longer than 72 inches.	"	"	"	"	2	4	7	10	
	Longer than 72 inches. Not longer than 96 inches.	"	"	"	"	2	6	9		
	Longer than 96 inches. Not longer than 120 inches.	"	"	"	1	3				
	Longer than 120 inches.	"	"	1	2					
Wider than 36 ins. but not wider than 48 inches.	Not longer than 72 inches.	"	"	1	2	4	7	10		
	Longer than 72 inches. Not longer than 96 inches.	"	"	1	3	5	8			
	Longer than 96 inches. Not longer than 120 inches.	"	"	2	4	8				
	Longer than 120 inches.	"	1	3	6					
Wider than 48 ins. but not wider than 60 inches.	Not longer than 72 inches.	"	Base	1	3	6	11			
	Longer than 72 inches. Not longer than 96 inches.	"	"	2	4	9				
	Longer than 96 inches. Not longer than 120 inches.	"	1	3	6					
	Longer than 120 inches.	1	2	4	8					
Wider than 60 ins. but not wider than 72 ins.	Not longer than 96 inches.	Base	1	3	8					
	Longer than 96 inches. Not longer than 120 inches.	"	2	5	10					
	Longer than 120 inches.	1	3	8						
Wider than 72 ins. but not wider than 108 ins.	Not longer than 96 inches.	1	3	6						
	Longer than 96 inches. Not longer than 120 inches.	2	4	7						
	Longer than 120 inches.	3	5	9						
Wider than 108 ins.	Not longer than 132 inches.	4	6							
	Longer than 132 inches.	5	8							

The longest dimension in any sheet shall be considered at its length.

CIRCLES, SEGMENTS AND PATTERN SHEETS, advance over prices of Sheet Copper required to cut them from 3 cents per pound.

COLD OR HARD ROLLED COPPER, 14 oz. per square foot, and heavier, add 1 " " "

COLD OR HARD ROLLED COPPER, lighter than 14 oz., per square foot, add 2 " " "

POLISHED COPPER, 20 INCHES WIDE and under, advance over price for Cold Rolled Copper of corresponding dimensions and thickness 1 " " sq. ft.

POLISHED COPPER, WIDER THAN 20 INCHES, advance over price for Cold Rolled Copper of corresponding dimensions and thickness 2 " " " "

COLD ROLLED COPPER, PREPARED SUITABLE FOR POLISHING, same as Polished Copper of corresponding dimensions and thickness.

COLD ROLLED AND ANNEALED COPPER SHEETS OR CIRCLES, same price as Cold or Hard Rolled Copper of corresponding dimensions and thickness.

ROUND COPPER ROD, ¾ inch diameter or over ..... **Base Price.**

(Rectangular, Square and Irregular Shapes, Copper Rod, Special Prices.)

ZINC—Duty, sheet, 1⅝c. per lb.	Cents per lb.
Carload lots, standard sizes and gauges, at mill	8.00 less 8%
Casks, jobbers' prices	8.50
Open casks, jobbers' prices	9.00

Metal Prices, September 11, 1911

PRICES ON BRASS MATERIAL—MILL SHIPMENTS,

In effect July 1, 1911, and until further notice.

To customers who purchase less than 40,000 lbs. per year and over 5,000 lbs. per year.

	Net base per lb. High Brass.	Low Brass.	Bronze.
Sheet	$0.13⅝	$0.14¾	$0.15⅞
Wire	.13⅝	.14⅝	.15⅞
Rod	.13⅝	.15½	.16⅞
Brazed tubing	.18½	—	.20⅝
Open seam tubing	.16½	—	.18⅝
Angles and channels, plain	.16¾	—	.18⅝

50% discount from all extras as shown in American Brass Manufacturers' Price List No. 8.

NET EXTRAS FOR QUALITY.

Sheet—Extra spring drawing and spinning brass	½c.	per lb. net advance
" —Best spring, drawing and spinning brass	1½c.	" " " "
Wire —Extra spring and brazing wire	½c.	" " " "
" —Best spring and brazing wire	1c.	" " " "

To customers who purchase less than 5,000 lbs. per year.

	Net base per lb. High Brass.	Low Brass.	Bronze.
Sheet	$0.14⅝	$0.15¾	$0.16⅞
Wire	.14⅝	.15¾	.16⅞
Rod	.14⅝	.16½	.17⅞
Brazed tubing	.19½	—	.21⅝
Open seam tubing	.17½	—	.19⅝
Angles and channels, plain	.17¾	—	.19⅝

5% discount from all extras as shown in American Brass Manufacturers' Price List No. 8.

NET EXTRAS FOR QUALITY.

Sheet—Extra spring, drawing and spinning brass	½c.	per lb. net advance
" —Best spring, drawing and spinning brass	1½c.	" " " "
Wire —Extra spring and brazing wire	½c.	" " " "
" —Best spring and brazing wire	1c.	" " " "

BARE COPPER WIRE—CARLOAD LOTS.

13.75c. per lb. base.

SOLDERING COPPERS.

300 lbs. and over in one order	17½c. per lb. base
100 lbs. to 300 lbs. in one order	18c. " " "
Less than 100 lbs. in one order	19½c. " " "

PRICES FOR SEAMLESS BRASS TUBING.

From 1¼ to 3½ in O. D. Nos. 4 to 13 Stubs' Gauge, 18c. per lb.
Seamless Copper Tubing, 21c. per lb.

For other sizes see Manufacturers' List.

PRICES FOR SEAMLESS BRASS TUBING Iron Pipe Sizes.

Iron pipe Size	⅛	¼	⅜	½	¾	1	1¼	1½	2	2½	3	3½	4	4½	5	6
Price per lb.	26	25	20	19	18	18	18	18	18	18	18	19	20	22	24	25

PRICE LIST OF IRON LINED TUBING—NOT POLISHED.

	Per 100 feet Brass.	Bronze.
⅜ inch	$8	$9
½ inch	8	9
⅝ inch	10	11
¾ inch	12	13
⅞ inch	14	15
1 inch	18	20
1⅛ inch	22	24
1¼ inch	25	27
1½ inch	32	35
1¾ inch	45	48
2 inch	56	60

Discount 55 and 5%.

PRICES FOR TOBIN BRONZE AND MUNTZ METAL.

Tobin Bronze Rod	16c.	net base
Munts or Yellow Metal Sheathing (14" x 48")	14c.	" "
" " " Rectangular sheets other than Sheathing	16c.	" "
" " " Rod	14c.	" "

Above are for 100 lbs. or more in one order.

PLATERS' METALS.

Platers' bar in the rough, 22⅝c. net.

German silver platers' bars dependent on the percentage of nickel, quantity and general character of the order.

Platers' metal, so called, is very thin metal not made by the larger mills and for which prices are quoted on application to the manufacturers.

PRICES FOR SHEET BLOCK TIN AND BRITANNIA METAL.

Not over 18 in. in width, not thinner than 23 B. S. Gauge, 2c. above price of pig tin in same quantity.

Not over 35 in. in width, not thinner than 22 B. S. Gauge, 3c. above price of pig tin.

PRICE SHEET FOR SHEET ALUMINUM—B. & S. Gauge.

	Wider than..... 3in. 6in. 14in. 16in. 18in. 20in. 24in. 30in. 36in.
	and including..... 12in. 14in. 16in. 18in. 20in. 24in. 30in. 36in. 40in.
	in coils.
No. 13 and heavier	34 34 36 36 36 36 39 39 39
" 14	34 34 36 36 36 36 39 39 39
" 15	34 34 36 36 36 36 39 39 39
" 16	34 34 36 36 36 36 39 39 39
" 17	34 34 36 36 36 36 39 39 39
" 18	34 34 36 36 36 36 39 39 42
" 19	34 34 36 36 36 36 39 40 43
" 20	34 36 36 36 36 38 41 42 44
" 21	34 38 38 38 38 40 43 44 50
" 22	34 38 38 38 40 40 43 47 51
" 23	34 38 38 38 40 40 43 49 52
" 24	34 38 40 42 42 42 45 51 54
" 25	36 39 41 43 43 43 46 53 57
" 26	36 39 42 46 46 46 51 55 61
" 27	36 40 44 48 48 49 54 58 64
" 28	36 40 46 48 49 49 56 62 67
" 29	38 41 48 50 52 52 61 67 72
" 30	38 42 50 52 56 62 60 72 77
" 31	43 47 55 58 63 71 74 77 83
" 32	45 49 57 61 69 77 91 90 95
" 33	47 51 60 65 73 84 91 100 110
" 34	50 55 62 70 78 91 103 110 120
" 35	.. 65 70 80 90 100 115 125 ..
" 36	.. 80 90 100 115 120 135 .. ..
" 37	.. 104 114 129 144 159 174 .. ..
" 38	.. 124 139 154 169 184 204 .. ..
" 39	.. 144 164 184 204 224 .. .. ..
" 40	.. 174 204 224 244 .. ..

In flat rolled sheets the above prices refer to lengths between 2 and 3 feet. Prices furnished by the manufacturers for wider and narrower sheet. All columns except the first refer to flat rolled sheet. Prices are 100 lbs. or more at one time. Less quantities 5c. lb. extra. Charges made for boxing.

PRICE LIST SEAMLESS ALUMINUM TUBING.

STUBS' GAUGE THE STANDARD. SIZES CARRIED IN STOCK.
Outside Diameters. BASE PRICE, 25 Cents per Pound.

Stubs' Gauge.	Inches.	¼ in.	5-16 in.	⅜ in.	½ in.	⅝ in.	¾ in.	⅞ in.	1 in.	1¼ in.	1½ in.	1¾ in.	2 ins.	2½ ins.	3 ins.	3½ ins.	4 ins.	4½ ins.
11.	.120.	..	..	..	..	..	..	..	27	24	..	..	14	20	10	9	16	23
12.	.109.	..	..	..	..	..	..	..	26	..	..	..	15	..	..	..	..	..
14.	.083.	..	..	..	..	..	..	..	..	..	..	..	17	..	..	..	..	..
16.	.065.	..	..	..	..	..	28	27	27	24	23	21	21	21	21	27	31	57
18	.049.	..	..	..	..	33	30	29	28	25	26	26	26	..	..	..	..	..
20.	.035.	117	..	46	39	34	33	32	30	29	30	30	30	31	38	40	58	81
21.	.032.	..	..	..	40	..	..	..	..	..	..	..	..	..	..	..	..	..
22.	.028.	138	98	48	42	38	37	35	34	..	..	45	..	..	..	..	..	..
24.	.022.	188	133	108	88	79	73	62	60	66	..	..	..	..	..	..	..	..

Prices are for ten or more pounds at one time. For prices on sizes not carried in stock send for Manufacturers' List.

PRICE LIST FOR ALUMINUM ROD AND WIRE.

Diameter. B. & S.G'ge.	000 to No. 10.	No. 11.	No. 12.	No. 13.	No. 14.	No. 15.	No. 16.	No. 17.	No. 18.	No. 19.	No. 20.	No. 21.	No. 22.
Price, per lb....	32	32½	32½	33	33½	34	34½	35	36	37	38	43	46

PRICE LIST FOR GERMAN SILVER IN SHEETS AND ROLLS.

Per cent.	Price per lb.	Per cent.	Price per lb.
12	$0.52	16	$0.58
13	.53	17	.59
14	.54	18	.60
15	.55		

These prices are for sheets and rolls over 2 inches in width, to and including 8 inches in width and to No. 20, inclusive. American or Brown & Sharpe's Gauge. Prices are for 100 lbs. or more of one size and gauge in one order. Discount 50%.

GERMAN SILVER TUBING.

4 per cent.	to No. 19,	B. & S. Gauge,	inclusive	$0.60
6 "	" 19,	" "	"	.70
9 "	" 19,	" "	"	.85
12 "	" 19,	" "	"	1.00
15 "	" 19,	" "	"	1.15
16 "	" 19,	" "	"	1.20
18 "	" 19,	" "	"	1.30

German Silver Tubing thinner than No. 19 B. & S. Gauge add same advances as for Brazed Brass Tube.

For cutting to special lengths add same advances as for Brazed Brass Tube. Discount 40%.

PRICES OF SHEET SILVER.

Rolled sterling silver .925 fine is sold according to gauge quantity and market conditions. No fixed quotations can be given, as prices range from 2c. below to 6c. above the price of bullion.

Rolled silver anodes .999 fine are quoted at 2c. to 3½c. above the price of bullion.

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INGOT, PLATE, SHEET, ROD, WIRE, TUBE, METAL GOODS.

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BRASS { SHEET / ROD / WIRE COPPER { SHEET / ROD / WIRE

GERMAN SILVER { SHEET / ROD / WIRE

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Copper and Yellow

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NAVAL BRONZE
MANGANESE BRONZE
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in Sheets and Rolls

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German Silver

Brass, Copper and Bronze in Sheets, Wire, Rods and Tubes

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ANODES

Phosphor Bronze

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BRONZE AND
PURE COPPER

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SHEET OR WIRE

Silver Solder

SHEET OR WIRE

Sheet Brass Solder

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In Sheets and Rolls, Rods, Wire and Tubing.

Low Brass, Bronze and Oreide
In Sheets and Rolls, Rods, Wire and Tubing.

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From 4 in. Diameter to 1-64 in.
Finished Bright, Smooth and Accurate to 1-1000 Ins. Inside and Out
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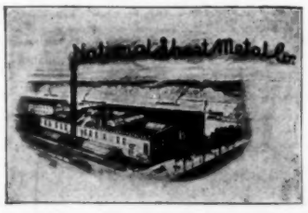

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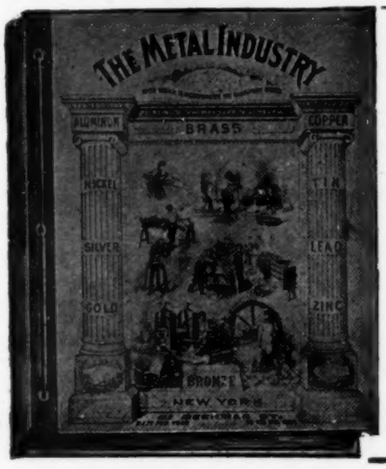

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Foundry foremen and managers wishing to know the secrets of metal mixing, also cost and loss system, send for the book "THE METAL MIXER," written by an expert. Price, $1.00. Address, A. DEVINE, 121 E. Patterson Avenue, Columbus, Ohio.

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WANTED—Second-hand 6 or 8 h. p. horizontal engine and boiler. State what make, condition and price. Address HORIZONTAL, care THE METAL INDUSTRY.

WANTED—A copy of THE METAL INDUSTRY for February, 1905. Address FEBRUARY, care THE METAL INDUSTRY.

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WANTED—The Agency for some American Hardware firms in England. Address HARDWARE, care THE METAL INDUSTRY.

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Inquiries received by THE METAL INDUSTRY for Metals, Machinery and Supplies. Further particulars may be obtained by addressing the inquiry number, care THE METAL INDUSTRY. No charge for inserting these inquiries.

Inquiry No. 344—We would like to correspond with the manufacturers of brass, or brass and lead anti-slip stair treads. Also firms who can undertake the casting and finishing of bronze stair newel posts and handrailings.

Inquiry No. 345—We would like to correspond with firms who can do die-casting in aluminum.

Inquiry No. 346—I would like to correspond with firms who would be likely to take up an agency for the sale of aluminum, platinum and metal alloys of all descriptions.

Inquiry No. 347—We would like to correspond with the manufacturers of celluloid grinding wheels.

Inquiry No. 348—We are contemplating the establishing of a retinning plant in our factory and would like to correspond with the manufacturers of tinning pots, tanks, pyrometers and all of the other supplies necessary in this line of work.

Inquiry No. 349—We would like to correspond with the buyers of bundled sheet scrap, also heavy melting.

Inquiry No. 350—We would like to correspond with the manufacturers of "salt-water" gold plating equipment.

Inquiry No. 351—We would like to correspond with the manufacturer of Wheel Brand and Dewrance white metals.

Inquiry No. 352—We are in the market for a metal testing scale to determine the percentage of tin in alloys, and would like to correspond with the manufacturers.

Inquiry No. 353—We would like to correspond with the manufacturers of the cleaning material known as "Solventine" or "Scaline."

Inquiry No. 354—We would like to secure information relative to a Richards computing scale.

Inquiry No. 355—We would like to secure some copper oxide electrodes for use in electro-deposition in which we wish to consume the hydrogen by copper oxide cathodes.

Inquiry No. 356—We would like to correspond with the sellers of French clay, also abestine.

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WANTED—SUPERINTENDENT, METAL DEPARTMENT, of a large manufacturing concern. One who thoroughly understands the making and finishing of articles from sheet metals. No one who is not thoroughly experienced need apply. Permanent position to right party. Address METAL EXPERT, care THE METAL INDUSTRY.

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WANTED—A capable young man under thirty-five, to supervise SHEET ROLLING DEPARTMENT of well-established industry. Technical graduate preferred. Address SUPERVISOR, care THE METAL INDUSTRY.

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WANTED—A good man who is thoroughly conversant in both electrolytic and general smelting and assaying. A good opening for such a man. Address ELECTROLYTIC, care THE METAL INDUSTRY.

SITUATIONS OPEN—Continued

DIE CASTER

WANTED—A MANAGING SUPERINTENDENT capable of taking complete charge of a DIE CASTING PLANT in CANADA, preferably one who can become interested financially and act as director. Address CANADA MANAGER, care THE METAL INDUSTRY.

PLATERS AND POLISHERS

WANTED—Foreman for Plating Works, one who understands the Mechanical Electro-Plating Machines. Fine chance for the right man. Give age, experience and wages wanted. All answers kept confidential. Address "FOREMAN," care THE METAL INDUSTRY.

NAME PLATE PRINTER

WANTED—NAME PLATE PRINTER. Workman who can operate hand press for etched plate work. Address ETCHED PLATE, care THE METAL INDUSTRY.

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SITUATION WANTED.—By an Expert Cost Accountant, Cashier, Paymaster, also Purchasing Agent. Have had eight years' experience with one of the leading plating supply houses, both in office and as salesman. Can furnish the best of references. Address EXPERT ACCOUNTANT, care THE METAL INDUSTRY.

SITUATION WANTED—I am desirous of making a change in September. For the past four years I have been GENERAL MANAGER of a leading plant making PLUMBING SUPPLIES and previous seven years general office and factory experience. Age 31, married, active, energetic and thoroughly capable. Correspondence solicited and references exchanged. Address, PLUMBING MANAGER, care THE METAL INDUSTRY.

SITUATION WANTED—Open for position on July 15th, a thorough factory man of 18 years' experience in the manufacturing of brass goods, with modern methods, up-to-date on system, economical tool design and equipment, cost of production, etc. Correspondence invited. Address FACTORY MAN, care THE METAL INDUSTRY.

SITUATION WANTED—BRASS FOUNDRY SUPERINTENDENT or FOREMAN. Thoroughly experienced on ALUMINUM CASTINGS for automobiles, valve, pump and general jobbing lines. Thirty-two years old, temperate and a hustler. Well up on molding machines and mixing metals. Address 0-2, care THE METAL INDUSTRY.

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SITUATION WANTED—CHEMICAL ENGINEER of two years' experience wishes to communicate with a BRASS FOUNDRY desiring a college man who has both business and technical experience and who makes a specialty of Manganese Bronze and Aluminum. Address INGOT, care THE METAL INDUSTRY.

SITUATION WANTED—Young man, 19, at present attending Cooper Union Chemical School evenings, wishes to begin with a manufacturing concern where advancement is assured. Can furnish highest references as to character and ability. Position must be in New York City or immediate vicinity. M. O., 125 Suffolk St.

SITUATION WANTED—By a practical STEAM and ELECTRICAL ENGINEER, 2nd class N. Y. license; wishes steady employment. Holding a responsible position for the last 8 years with a large modern electrical plant. Good reference; capable of taking charge. Address T. S., care THE METAL INDUSTRY.

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SITUATION WANTED—As ROD ROLLER in Brass Rod Mill. Have had charge of a rod mill for years. Can furnish the best of reference. Address ROD ROLLER, care THE METAL INDUSTRY.

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SITUATION WANTED—FOREMAN METAL PATTERN MAKER experienced on steam specialties and plumbers' brass goods, also the manufacture of general brass goods. Address B, care THE METAL INDUSTRY.

FOUNDERS

SITUATION WANTED—By a first-class FOUNDRY FOREMAN; 30 years' experience on all classes of work, including plumbers' supplies, valves, automobile and jobbing. Can handle help to advantage. Also knows all saving devices for melting and molding and mixing metals from lead to gold. Address P. B. O., care THE METAL INDUSTRY.

SITUATION WANTED—Young man who is familiar with the manufacture of high tensile metals and alloys, desires a position. Address K., care THE METAL INDUSTRY.

SITUATION WANTED By a BRASS FOUNDRY FOREMAN. Can do my own mixing, and can handle crucible or Schwartz furnaces. Can also control help, and molding machines to advantage in the manufacture of valves, cocks, fittings, etc. Address B. F., care THE METAL INDUSTRY.

SITUATION WANTED—FOREMAN CHANDELIER or ARCHITECTURAL BRONZE CONSTRUCTION. Factory or outside position. Capable of handling men to best advantage. Would also consider salesmanship with well established house. Address D. E., care THE METAL INDUSTRY.

SITUATION WANTED—By a PLASTER COMPOSITION FOUNDRYMAN with 9 years' experience at fine arts castings in metals, plaster, wax and glue; also for patterns for engraving machines. Address P. C. F., care THE METAL INDUSTRY.

SITUATION WANTED—By ALUMINUM FLOOR MOLDER thoroughly familiar with heavy and light work. Have had 19 years' experience. Address N. J., care THE METAL INDUSTRY.

BRASS FINISHER

SITUATION WANTED—FOREMAN BRASS FINISHER, practical mechanic who has had foreman's experience and well versed in the up-to-date methods of manufacture of plumbers' and steamfitters' supplies; repair jobbing and specialty work; 18 years' experience; good references. Address FOREMAN BRASS FINISHER, care THE METAL INDUSTRY.

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SITUATION WANTED—Thoroughly practical transfer etcher on silver, brass, copper and organic substances, desires to make a change. Good recommendations. Address X. T., care THE METAL INDUSTRY.

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ELECTROPLATERS

Any one desiring the services of first class men for the electrodeposition of metals and finishing in all branches and departments of the plating business can secure such services by corresponding with the Secretary of the National Electro-Platers' Association, Royal F. Clark, 246 Fulton Street, Jersey City, N. J.

SITUATION WANTED—By a PLATER 30 years of age, with 5 years' experience on CHANDELIERS and 6 years' on jobbing work. Please give full details of position. Address K. J., care THE METAL INDUSTRY.

SITUATION WANTED—By a PLATER experienced on electroplating and coloring. Can furnish reference from last employer, Tiffany Studios. Address V. L. G., care THE METAL INDUSTRY.

SITUATION WANTED—PLATER, BUFFER and POLISHER, now working, desires position in the East where mental effort and ability would be tolerated. Plates in copper, brass, bronze, nickel, silver, gold, platinum, zinc and tin. Makes all chandelier, hardware and art metal finishes. Can install economic and efficient system. Address EXPERT PLATER, care THE METAL INDUSTRY.

SITUATION WANTED—By a PLATER with several years' experience on Nickel, Brass, Copper, Bronze Solutions, oxidizing and dipping. Address J-23, care THE METAL INDUSTRY.

SITUATION WANTED—By a GILDER EXPERT on shades of GOLD COLORING. Age 35. Position in Newark or New York City preferred. Address JEWELRY, care THE METAL INDUSTRY.

SITUATION WANTED—By a PLATER. First-class man on nickel, brass, copper, silver, black nickel; understands all hardware finishes, etc. Address N-2, care THE METAL INDUSTRY.

SITUATION WANTED—By a FOREMAN PLATER who is up to date on all finishes and colors. Desires a position with a good firm. Salary $30 per week. Address D-1, care THE METAL INDUSTRY.

SITUATION WANTED—Expert up-to-date NOVELTY ELECTROPLATER who has run the largest jewelry plant in the East. Address BOX 101, care THE METAL INDUSTRY.

SITUATION WANTED—By a FOREMAN-PLATER who thoroughly understands the plating business from A to Z. Has had several years' experience and is capable of taking charge. Address P. H., care THE METAL INDUSTRY.

SITUATION WANTED—By a PLATER having had ten years' experience on all metals and finishes. Can furnish best of reference. Address CONNECTICUT, care THE METAL INDUSTRY.

SITUATION WANTED—Position as ELECTRO-GILDER and PLATER. Expert worker in jobbing, gilding and plating. Address JOB GILDER, care THE METAL INDUSTRY.

SITUATION WANTED—By an ELECTRO-PLATER, 18 years' experience with Nickel, Copper, Brass and Bronze solutions and oxidizing. Can furnish good reference. Address BOX M-9, care THE METAL INDUSTRY.

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Practical platers consider this one of the best hand books on plating, particularly for young men. It explains the subject clearly and plainly from the management of batteries and dynamos to methods of using lacquers.

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A treatise covering the production of every shade of color which can be produced on metals. Discussed under, 1, chemical metal-coloring; 2, electro-chemical metal-coloring; 3, mechanical metal-coloring.

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One of the latest American books on this subject. A manual for the electro-plater, giving modern methods of polishing, plating, buffing, oxydizing and lacquering metals. Numerous formulae.

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Leiman Bros., New York.
Pangborn, Thomas W., Co., Jersey City, N. J.

Dynamos, Platers' and Galvanizers' (See also Platers' Supplies).
Backus & Leeser Co., New York.
Bennett-O'Connell Co., Chicago, Ill.
Bogue, Chas. J., Electric Co., New York.
Canning, W. Co., Birmingham, England.
Connecticut Dynamo & Motor Co., Irvington, N. J.
Hanson & Van Winkle Co., Newark, N. J.
Leiman Bros., New York.
L'Hommedieu, C. F., & Sons, Chicago, Ill.
Munning-Loeb Co., Matawan, N. J.
Oliver, W. W., Mfg. Co., Buffalo, N. Y.
U. S. Electro Galvanizing Co., Brooklyn, N. Y.

Electric Cleaning Compounds (See Metal Cleaning Compounds).

Electroplaters' Centrifugal Dryers
Tolhurst Machine Works, Troy, N. Y.

Electroplating, Polishing, Coloring, Etc.
Electro Bronze Co., Arlington, N. J.
Northern Ohio Mfg. & Refg. Works, Cleveland, O.
Sargeant Mfg. Co., Newark, N. J.

Emery (See Platers' Supplies).

Emery Wheels (See Grinding Machinery, etc.)

Enameling Ovens.
Gehnrich, Herrmann, New York.
Rockwell Furnace Co., New York.
Steiner, E. E., Newark, N. J.

Engineers, Mechanical, Foundry, Etc.
Pangborn, Thomas W., Co., Jersey City, N. J.
Smith, J. D., Foundry Supply Co., Cleveland, O.

Escutcheon Pins, All Metals
Hassall, John, New York.

Etched Name Plates.
Schweizer, Max, Bridgeport, Conn.

Exhaust Fans.
Cleveland Blow Pipe & Mfg. Co., Cleveland, O.
Lederer, F. J., Co., Buffalo, N. Y.
Leiman Bros., New York.
Pangborn, Thomas W., Co., Jersey City, N. J.

Expert Instruction -Plating, Coloring, Dipping, Etching, Etc.
Schweizer, Max, Bridgeport, Conn.

Extractors, Centrifugal Drying
American Tool & Machine Co., Boston, Mass.
Tolhurst Machine Works, Troy, N. Y.

Fire Brick (See also Foundry Supplies).
Detroit Foundry Supply Co., Detroit, Mich.
Stevens, Frederic B., Detroit, Mich.

Flasks, Brass Molders' (See also Foundry Supplies).
McPhee, Hugh, Tarrytown, N. Y.
Middleditch, Benj., Detroit, Mich.
Nicholls, W. H., New York.
Osborn Mfg. Co., Cleveland, O.
Sterling Wheelbarrow Co., West Allis, Wis.

Fluxes, Metal (See also Foundry Supplies).
Bassite Smelting & Mfg. Co., Cincinnati, O.
Reeves, Paul S., & Son, Philadelphia, Pa.
Uraniumite Co. of America, Buffalo, N. Y.

Fluxes, Soldering and Tinning
Grasselli Chemical Co., Cleveland, O.
Reeves, Paul S., & Son, Philadelphia, Pa.
Richards & Co., Boston, Mass.

Forgings, Automobile
American Manganese Bronze Co., New York.
Bliss, E. W., Co., Brooklyn, N. Y.
Phosphor Bronze Smelting Co., Philadelphia, Pa.

Foundry Facings (See also Foundry Supplies).
Detroit Foundry Supply Co., Detroit, Mich.
Dixon, Jos., Crucible Co., Jersey City, N. J.
McKesson & Robbins, New York.
Paxson, J. W., Co., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.

Foundry Supplies and Equipment.
Bassite Smelting & Mfg. Co., Cincinnati, O.
Birkenstein, S., & Sons, Chicago, Ill.
Detroit Foundry Supply Co., Detroit, Mich.
Fisher, Alfred, Chicago, Ill.
Hawley Down Draft Furnace Co., Chicago, Ill.
Kroschell Bros. Co., Chicago, Ill.
McPhee, Hugh, Tarrytown, N. Y.
Middleditch, Benj., Detroit, Mich.
Monarch Eng. & Mfg. Co., Baltimore, Md.
Nicholls, Wm. H., New York.
Obermayer Co., The S., Cincinnati, O.
Osborn Mfg. Co., Cleveland, O.
Pangborn, Thomas W., Co., Jersey City, N. J.
Paxson, J. W., Co., Philadelphia, Pa.
Smith, J. D., Foundry Supply Co., Cleveland, O.
Sterling Wheelbarrow Co., West Allis, Wis.
Stevens, Frederic B., Detroit, Mich.
Thompson & Co., Inc., Lewis, Philadelphia, Pa.
Uraniumite Co. of America, Buffalo, N. Y.

Furnace Linings (See also Foundry Supplies).
Detroit Foundry Supply Co., Detroit, Mich.
Kroeschell Bros. Co., Chicago, Ill.
Paxson, J. W., Co., Philadelphia, Pa.
Rockwell Furnace Co., New York.
Stevens, Frederic B., Detroit, Mich.

Furnaces, Annealing, Brazing, Etc.
Detroit Foundry Supply Co., Detroit, Mich.
Fisher, Alfred, Chicago, Ill.
Hartley, Spalckhaven & Fay, New York.
Monarch Eng. Mfg. Co., Baltimore, Md.
Rockwell Furnace Co., New York.
Rockwell, W. S., Co., New York.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Furnaces, Electric
Bristol Co., The, Waterbury, Conn.

Furnaces, Galvanizing and Tinning
Farrel Foundry & Machine Co., Ansonia, Conn.
Monarch Eng. & Mfg. Co., Baltimore, Md.
Rockwell Furnace Co., New York.
Rockwell, W. S., Co., New York.

Furnaces, Melting, for Oil, Coal, Coke, or Gas. (See also Foundry Supplies).
Chicago Flexible Shaft Co., Chicago, Ill.
Detroit Foundry Supply Co., Detroit, Mich.
Fisher, Alfred, Chicago, Ill.
Hawley Down Draft Furnace Co., Chicago, Ill.
Ideal Furnace Co., Chester, Pa.
Kroeschell Bros. Co., Chicago, Ill.
Monarch Eng. & Mfg. Co., Baltimore, Md.
Paxson, J. W., Co., Philadelphia, Pa.
Rockwell Furnace Co., New York.
Rockwell, W. S., Co., New York.

Furnaces, Reverberatory
Rockwell Furnace Co., New York.
Rockwell, W. S., Co., New York.

Fusel Oil, Refined (See also Platers' Supplies).
McKesson & Robbins, New York.
Nikolas, G. J., & Co., Chicago, Ill.

Galvanized Specialties, Nails, Screws, Etc.
U. S. Electro Galvanizing Co., Brooklyn, N. Y.

Galvanizing Plants and Equipment.
(See also Platers' and Polishers' Supplies).
Globe Machine & Stamping Co., Cleveland, O.
Hanson & Van Winkle Co., Newark, N. J.
Meaker Co., Chicago, Ill.
U. S. Electro Galvanizing Co., Brooklyn, N. Y.

Galvanizing Barrels and Automatic Devices.
Globe Machine & Stamping Co., Cleveland, O.
Meaker Co., Chicago, Ill.
U. S. Electro Galvanizing Co., Brooklyn, N. Y.

Galvanizing for the Trade.
U. S. Electro Galvanizing Co., Brooklyn, N. Y.

Gas Producers and Power Plants
Wood, R. D., & Co., Philadelphia, Pa.

German Silver Ingots, Castings, Etc.
Buermann Mfg. Co., August, Newark, N. J.
Reeves, Paul S., & Son, Philadelphia, Pa.
Riverside Metal Co., Riverside, N. J.
Seymour Manufacturing Co., The, Seymour, Conn.

German Silver Sheets, Wire, Rods, Tubes, Etc.
Michigan Copper & Brass Co., Detroit, Mich.
Pilling Brass Co., Waterbury, Conn.
Reeves, Paul S., & Son, Philadelphia, Pa.
Riverside Metal Co., Riverside, N. J.
Scovill Manufacturing Co., Waterbury, Conn.
Seymour Manufacturing Co., The, Seymour, Conn.
Waterbury Brass Co., Waterbury, Conn.

Gold Alloys.
Riverside Metal Co., Riverside, N. J.

Gold Ingots, Bars, Plates, Etc.
Renzlehausen, Wm. F., Co., Newark, N. J.
Riverside Metal Co., Riverside, N. J.

Graphite (See Foundry Supplies).

Grinding Machinery.
Bennett-O'Connell Co., Chicago, Ill.
Blake & Johnson Co., Waterbury, Conn.
Connecticut Dynamo & Motor Co., Irvington, N. J.
Osborn Mfg. Co., Cleveland, O.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Grinding Wheels (See also Foundry Supplies).
Carborundum Co., Niagara Falls, N. Y.

Heat Gages.
Bristol Co., Waterbury, Conn.

Hoists, Electric, Pneumatic, Hand
Detroit Foundry Supply Co., Detroit, Mich.

Hydraulic Accumulators.
Watson-Stillman Co., New York.
Wood, R. D., & Co., Philadelphia, Pa.

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Hydraulic Machinery, Presses, Jacks, Etc.
Farrel Foundry & Machine Co., Ansonia, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.
Watson-Stillman Co., New York.
Wood, R. D., & Co., Philadelphia, Pa.

Iron, Scrap, Dealers in
Smith, The Morton B., Brooklyn, N. Y.

Iron Tubes, Brass and Bronze Covered
Phenix Tube Co., Brooklyn, N. Y.

Japanning Ovens.
Gehnrich, Hermann, New York.
Rockwell Furnace Co., New York.
Steiner, E. E., Newark, N. J.

Jewelers' Equipment and Supplies (See also Platers' Supplies).
Leiman Bros., New York.
Oliver, W. W., Mfg. Co., Buffalo, N. Y.
Tolhurst Machine Works, Troy, N. Y.

Jewelers' Findings.
Smith & Richardson, Attleboro, Mass.

Kettles, Galvanizing and Tinning (See also Platers' Supplies).
Farrel Foundry & Machine Co., Ansonia, Conn.

Lacquer Enamels. (See also Platers' Supplies).
Celluloid Zapon Co., New York.
Egyptian Lacquer Mfg. Co., New York.
Eureka Pneumatic Spray Co., New York.
Hanson & Van Winkle Co., Newark, N. J.

Lacquering Ovens.
Gehnrich, Hermann, New York.
Steiner, E. E., Newark, N. J.

Lacquer Sprayers.
Eclipse Air Brush & Compressor Co., Bloomfield, N. J.
Eureka Pneumatic Spray Co., New York.
Lederer, F. J., Co., Buffalo, N. Y.
Paasche Air Brush Co., Chicago, Ill.

Lacquers, Metal (See also Platers' Supplies).
American Lacquer Co., Bridgeport, Conn.
Celluloid Zapon Co., New York.
Chemical Products Co., Boston, Mass.
Egyptian Lacquer Manufacturing Co., New York.
Eureka Pneumatic Spray Co., New York.
General Bakelite Co., New York.
Hanson & Van Winkle Co., Newark, N. J.
Kalbfleisch, Franklin H., Co., New York.
Munning-Loeb Co., Matawan, N. J.
New Era Lustre Co., New Haven, Conn.
Nikolas, G. J., & Co., Chicago, Ill.

Ladle Heaters and Dryers (See also Foundry Supplies).
Detroit Foundry Supply Co., Detroit, Mich.
Hawley Down Draft Furnace Co., Chicago, Ill.
Monarch Eng. & Mfg. Co., Baltimore, Md.
Pangborn, Thomas W., Co., Jersey City, N. J.
Paxson, J. W., Co., Philadelphia, Pa.
Rockwell Furnace Co., New York.

Ladles (See also Foundry Supplies).
Detroit Foundry Supply Co., Detroit, Mich.

Lathes, Polishing (See Platers' and Polishers' Supplies).

Lathes, Spinning, Turning, Etc.
American Tool & Machine Co., Boston, Mass.
Bliss, E. W., Co., Brooklyn, N. Y.
Oliver, W. W., Mfg. Co., Buffalo, N. Y.
Pryibil, P., New York.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Lathes, Turret
American Tool & Machine Co., Boston, Mass.

Lead, Antimonial
Leavitt, C. W., & Co., New York.
Michigan Smelting & Refining Co., Detroit, Mich.
Richards & Co., Boston, Mass.
Standard Rolling Mills Inc., Brooklyn, N. Y.

Lead Castings, Antimonial
Electro Bronze Co., Arlington, N. J.
Standard Rolling Mills Inc., Brooklyn, N. Y.

Lead, Pig and Bar
American Smelting & Refining Co., Cincinnati, O.
Birkenstein, S., & Sons, Chicago, Ill.
Fitz, Dana & Co., Boston, Mass.
Hendricks Bros., New York.
Illinois Smelting & Refining Co., Chicago, Ill.
Merchant & Evans Co., Philadelphia, Pa.
Michigan Smelting & Refining Co., Detroit, Mich.
National Metal Reduction Co., Cleveland, O.
Richards & Co., Boston, Mass.
Standard Rolling Mills Inc., Brooklyn, N. Y.
U. S. Reduction Co., Chicago, Ill.

Lead Pipe.
North American Smelting Co., Philadelphia, Pa.

Leather Meal for Dry Tumbling.
Peckham Mfg. Co., Newark, N. J.

Lubricants.
Dixon, Joseph, Crucible Co., Jersey City, N. J.

Lycopodium (See also Foundry Suplies).
McKesson & Robbins, New York.

Mahogany Pattern Lumber.
Thompson & Co., Inc., Lewis, Philadelphia, Pa.

Manganese Bronze Ingots and Castings.
Ajax Metal Co., Philadelphia, Pa.
Allan, A., & Son, New York.
American Manganese Bronze Co., New York.
Atkinson Co., The, Rochester, N. Y.
Damascus Bronze Co., Pittsburgh, Pa.
Electric Smelting & Refining Co., Detroit, Mich.
Fitz, Dana & Co., Boston, Mass.
North American Smelting Co., Philadelphia, Pa.
Reeves, Paul S., & Son, Philadelphia, Pa.
Richards & Co., Boston, Mass.
Riverside Metal Co., Riverside, N. J.
Taunton-New B'fd Copper Co., New Bedford, Mass.

Manganese Bronze Sheets, Rods, Etc.
American Manganese Bronze Co., New York.
Taunton-New B'fd Copper Co., New Bedford, Mass.

Manganese Copper.
American Smelting & Refining Co., Cincinnati, O.
Electric Semlting & Alum. Co., Lockport, N. Y.
Reeves, Paul S., & Sons, Philadelphia, Pa.
Riverside Metal Co., Riverside, N. J.
Roessler & Hasslacher Chemical Co., New York.

Manganese Metal.
Leavitt, C. W., & Co., New York.
Reeves, Paul S., & Son, Philadelphia, Pa.
Roessler & Hasslacher Chemical Co., New York.

Magnesium Metal.
Leavitt, C. W., & Co., New York.
McKesson & Robbins, New York.
Roessler & Hasslacher Chemical Co., New York.

Magnetic Metal Separators (See also Foundry Supplies).
American Concentrator Co., Joplin, Mo.
Capitol Brass Works, Detroit, Mich.
Dings Electro-Mag. Separator Co., Milwaukee, Wis.
Pangborn, Thomas W., Co., Jersey City, N. J.

Match Plates
McPhee, Hugh, Tarrytown, N. Y.
Middleditch, Benj., Detroit, Mich.

Metals (See name of metal wanted).

Metal Cleaning Compounds (See also Platers' Supplies).
Anthony, H. M., & Co., New York.
Electric Smelt. & Aluminum Co., Lockport, N. Y.
Hanson & Van Winkle Co., Newark, N. J.
International Chemical Co., Camden, N. J.
Stevens, Frederic B., Detroit, Mich.
Swan & Finch Co., New York.

Metal Fluxes (See also Foundry Supplies).
Bassite Smelting & Mfg. Co., Cincinnati, O.
Reeves, Paul S., & Son, Philadelphia, Pa.
Uraniumite Co. of America, Buffalo, N. Y.

Metallurgists, Consulting.
Detroit Testing Laboratory, Detroit, Mich.
Krom, L. J., New York.
Ledoux & Co., New York.

Metals, Dealers in all Kinds of New (See also name of metal wanted).
Birkenstein, S., & Sons, Chicago, Ill.
Fitz, Dana & Co., Boston, Mass.
Merchant & Evans Co., Philadelphia, Pa.
Moers, Albert A., New York.
Richards & Co., Boston, Mass.

Metals, Dealers in Old
Birkenstein, S., & Sons, Chicago, Ill.
Genesee Metal Co., Rochester, N. Y.
Illinois Smelting & Refining Co., Chicago, Ill.
Smith, The Morton B. Co., New York.
Riverside Metal Co., Riverside, N. J.

Metals, Dealers in Old—Gold, Silver, Platinum
Renziehausen, Wm. F., Co., Newark, N. J.
Riverside Metal Co., Riverside, N. J.

Metal Goods Drying Machines
Tolhurst Machine Works, Troy, N. Y.

Metal Goods Made to Order.
Aluminum Goods Mfg. Co., Manitowoc, Wis.
Ansonia Brass & Copper Co., New York.
Bridgeport Brass Co., Bridgeport, Conn.
Buermann Mfg. Co., August, Newark, N. J.
Electro Bronze Co., Arlington, N. J.
Manhattan Brass Co., New York.
Riverside Metal Co., Riverside, N. J.
Sargeant Mfg. Co., Newark, N. J.
Scovil Manufacturing Co., Waterbury, Conn.
Waterbury Brass Co., Waterbury, Conn.

Metal, Plated Sheet
Benson, H. K. & F. S., Glen Ridge, N. J.
National Sheet Metal Co., Peru, Ill.

Metal Refiners, Gold and Silver.
Genesee Metal Co., Rochester, N. Y.
Renziehausen, Wm. F., Co., Newark, N. J.
Riverside Metal Co., Riverside, N. J.

Metal Refiners—White Metal.
Birkenstein, S., & Sons, Chicago, Ill.
Michigan Smelting & Refining Co., Detroit, Mich.
National Metal Reduction Co., Cleveland, O.
Reeves, Paul S., & Sons, Philadelphia, Pa.
Standard Rolling Mills Inc., Brooklyn, N. Y.

Metal, Silver Plated Sheet
Benson, H. K. & F. S., Glen Ridge, N. J.

Metal Spinning. (See also Metal Goods made to order).
Aluminum Goods Mfg. Co., Manitowoc, Wis.
Riverside Metal Co., Riverside, N. J.
Standard Rolling Mills Inc., Brooklyn, N. Y.

Metal Stamping. (See also Metal Goods made to order).
Aluminum Goods Mfg. Co., Manitowoc, Wis.
Globe Machine & Stamping Co., Cleveland, O.
Riverside Metal Co., Riverside, N. J.
Standard Rolling Mills Inc., Brooklyn, N. Y.

Metal Turnings, Drosses Residue, Etc., Buyers of
Birkenstein, S., & Sons, Chicago, Ill.
Illinois Smelting & Refining Co., Chicago, Ill.
Smith, The Morton B., Co., New York.
Whipple & Choate, Bridgeport, Conn.
White & Bro., Inc., Philadelphia, Pa.

Mold Dryers, Portable (See also Foundry Supplies).
Detroit Foundry Supply Co., Detroit, Mich.
Monarch Eng. & Mfg. Co., Baltimore, Md.
Pangborn, Thomas W., Co., Jersey City, N. J.
Paxson, J. W., Co., Philadelphia, Pa.
Rockwell Furnace Co., New York.

Mold Spraying Machines. (See also Foundry Supplies).
Pangborn, Thomas W., Co., Jersey City, N. J.

Molds, Ingot (See also Foundry Supplies).
Farrel Foundry & Machine Co., Ansonia, Conn.
Nicholls, Wm. H., New York.
Paxson, J. W., Co., Philadelphia, Pa.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Molding Machines. (See also Foundry Supplies).
Detroit Foundry Supply Co., Detroit, Mich.
McPhee, Hugh, Tarrytown, N. Y.
Nicholls, Wm. H., New York.
Osborn Mfg. Co., Cleveland, O.
Paxson, J. W., Co., Philadelphia, Pa.
Turner Machine Co., Philadelphia, Pa.

Monel Metal Sheets.
Merchant & Evans Co., Philadelphia, Pa.

Muntz's Metal—Sheets, Rods, Bolts, Nails, Etc.
Taunton-New B'fd Copper Co., New Bedford, Mass.

Nails. (See name of metal wanted).

Name Plates, Etched
Schweizer, Max, Bridgeport, Conn.

Nickel.
Hanson & Van Winkle Co., Newark, N. J.
Hendricks Bros., New York.
Leavitt, C. W., & Co., New York.
Merchant & Evans Co., Philadelphia, Pa.
Richards & Co., Boston, Mass.

Nickel-Bronze Castings and Ingots.
Damascus Bronze Co., Pittsburgh, Pa.

Nickel Castings.
Hanson & Van Winkle Co., Newark, N. J.

Nickel Salts. (See also Platers' Supplies).
Detroit Foundry Supply Co., Detroit, Mich.
Hanson & Van Winkle Co., Newark, N. J.
McKesson & Robbins, New York.
Munning-Loeb Co., Matawan, N. J.

Nickel, Shot
Merchant & Evans Co., Philadelphia, Pa.
Seymour Manufacturing Co., The, Seymour, Conn.

Nickel Silver Tubes.
Wells, A. H., & Co., Waterbury, Conn.

Oil Pumps and Storage Tanks.
Monarch Eng. & Mfg. Co., Baltimore, Md.
Rockwell Furnace Co., New York.

Oil Separators.
American Tool & Machine Co., Boston, Mass.

Oils, Tempering and Lubricating
McKesson & Robbins, New York.
Swan & Finch, New York.

Ovens. (See also Core, Lacquering, Enameling and Sherardizing Ovens).
Gehnrich, Hermann, New York.
Steiner, E. E., Newark, N. J.

Paint for Metals, Etc.
Woolsey, C. A., Co., Jersey City, N. J.

Parting Compounds. (See also Foundry Supplies)
Detroit Foundry Supply Co., Detroit, Mich.
Stevens, Frederic B., Detroit, Mich.

Pattern Lumber, Mahogany.
Thompson & Co., Inc., Lewis, Philadelphia, Pa.

Patterns, Mounted
McPhee, Hugh, Tarrytown, N. Y.

Pattern Shop Supplies (See Foundry Supplies).

Pewter.
Standard Rolling Mills Inc., Brooklyn, N. Y.

Phosphor Bronze Ingots, Castings, Etc.
Ajax Metal Co., Philadelphia, Pa.
Allan, A., & Son, New York.
Atkinson Co., The, Rochester, N. Y.
Damascus Bronze Co., Pittsburgh, Pa.
Illinois Smelting & Refining Co., Chicago, Ill.
Michigan Smelting & Refining Co., Detroit, Mich.
Phosphor Bronze Smelting Co., Philadelphia, Pa.
Reeves, Paul S., & Son, Philadelphia, Pa.
Riverside Metal Co., Riverside, N. J.
Seymour Mfg. Co., Seymour, Conn.

Phosphor Bronze Sheets, Wire, Rods, Etc.
Phosphor Bronze Smelting Co., Philadelphia, Pa.
Pilling Brass Co., Waterbury, Conn.
Reeves, Paul S., & Son, Philadelphia, Pa.
Riverside Metal Co., Riverside, N. J.
Seymour Mfg. Co., Seymour, Conn.

Phosphor Copper.
American Smelting & Refining Co., Cincinnati, O.
Damascus Bronze Co., Pittsburgh, Pa.
Electric Smelt. & Aluminum Co., Lockport, N. Y.
Michigan Smelting & Refining Co., Detroit, Mich.
North American Smelting Co., Philadelphia, Pa.
Reeves, Paul S., & Son, Philadelphia, Pa.
Richards & Co., Boston, Mass.
Riverside Metal Co., Riverdale, N. J.
Roessler & Hasslacher Chemical Co., New York.

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Phosphor Tin.
American Smelting & Refining Co., Cincinnati, O.
Damascus Bronze Co., Pittsburg, Pa.
Electric Smelt. & Aluminum Co., Lockport, N. Y.
Atkinson Co., The, Rochester, N. Y.
North American Smelting Co., Philadelphia, Pa.
Reeves, Paul S., & Son, Philadelphia, Pa.
Richards & Co., Boston, Mass.

Phosphorus. (See also Foundry Supplies).
General Chemical Co., Philadelphia, Pa.
McKesson & Robbins, New York.

Pickling Machines, Automatic
Torrington Manufacturing Co., Torrington, Conn.

Platers' Compound. (See also Platers' Supplies).
International Chemical Co., Camden, N. J.
Swan & Finch Co., New York.

Platers' Metal (See also Platers' Supplies).
Kemp, W. H., Co., New York.
Pilling Brass Co., Waterbury, Conn.

Platers', Polishers' and Galvanizers' Equipment and Supplies.
Abbott Ball Co., Hartford, Conn.
Anthony, H. M., Co., New York.
Backus & Leeser Co., New York.
Baird Machine Co., Oakville, Conn.
Bennett-O'Connell Co., Chicago, Ill.
Burns, E. Reed, Brooklyn, N. Y.
Canning, W., & Co., Birmingham, England.
Connecticut Dynamo & Motor Co., Irvington, N. J.
Detroit Foundry Supply Co., Detroit, Mich.
Divine Bros. Co., Utica, N. Y.
Globe Machine & Stamping Co., Cleveland, O.
Grasselli Chemical Co., Cleveland, O.
Hanson & Van Winkle Co., Newark, N. J.
International Chemical Co., Camden, N. J.
Klauder-Weldon Dy'g Mach. Co., Amsterdam, N. Y.
Leiman Bros., New York.
L'Hommedieu, C. F., & Sons, Chicago, Ill.
Meaker Company, Chicago, Ill.
McKesson & Robbins, New York.
Moyer, D. B., Walled Lake, Mich.
Munning-Loeb Co., Matawan, N. J.
Peckham Mfg. Co., Newark, N. J.
Platinum Metals Co., Brooklyn, N. Y.
Roessler & Hasslacher Chemical Co., New York.
Rockhill & Vietor, New York.
Roth Bros. Co., Chicago, Ill.
Smith & Richardson, Attleboro, Mass.
Stevens, Frederic B., Detroit, Mich.
Swan & Finch Co., New York.
Tolhurst Machine Works, Troy, N. Y.
U. S. Electro Galvanizing Co., Brooklyn, N. Y.

Plating Barrels and Apparatus.
(See also Platers' Supplies).
Abbott Ball Co., Hartford, Conn.
Backus & Leeser Co., New York.
Baird Machine Co., Oakville, Conn.
Bennett-O'Connell Co., Chicago, Ill.
Connecticut Dynamo & Motor Co., Irvington, N. J.
Detroit Foundry Supply Co., Detroit, Mich.
Globe Machine & Stamping Co., Cleveland, O.
Hanson & Van Winkle Co., Newark, N. J.
L'Hommedieu, C. F., & Sons Co., Chicago, Ill.
Klauder-Weldon Dy'g Mach. Co., Amsterdam, N. Y.
Munning-Loeb Co., Matawan, N. J.
Rockhill & Vietor, New York.
Smith & Richardson, Attleboro, Mass.
Tolhurst Machine Works, Troy, N. Y.
U. S. Electro Galvanizing Co., Brooklyn, N. Y.

Platinum Ingots.
Platinum Metals Co., Brooklyn, N. Y.

Platinum Salts and Solutions.
Platinum Metals Co., Brooklyn, N. Y.

Platinum Scrap, Buyers of
Platinum Metals Co., Brooklyn, N. Y.
Roessler & Hasslacher Co., New York.

Plumbago (See Graphite).

Polishing, Buffing and Burnishing Machinery and Appliances (See also Platers' Supplies).
Abbott Ball Co., Hartford, Conn.
Backus & Leeser Co., New York.
Baird Machine Co., Oakville, Conn.
Bennett-O'Connell Co., Chicago, Ill.
Cleveland Blow Pipe Co., Cleveland, O.
Connecticut Dynamo & Motor Co., Irvington, N. J.
Detroit Foundry Supply Co., Detroit, Mich.
Divine Bros. Co., Utica, N. Y.
Globe Machine & Stamping Co., Cleveland, O.
Hanson & Van Winkle Co., Newark, N. J.
Kirk & Blum, Cincinnati, O.
Knickerbocker Co., Jackson, Mich.
Leiman Bros., New York.
L'Hommedieu, C. F., & Sons, Chicago, Ill.
Middleditch, Benj., Detroit, Mich.
Moyer, D. B., Walled Lake, Mich.
Munning-Loeb Co., Matawan, N. J.
Oliver, W. W., Mfg. Co., Buffalo, N. Y.
Osborn Mfg. Co., Cleveland, O.
Peckham Mfg. Co., Newark, N. J.
Pfleghar Hardware Sp'lty Co., New Haven, Conn.
Roth Bros., Chicago, Ill.
Tolhurst Machine Works, Troy, N. Y.

Polishing Belts, Endless (See also Platers' Supplies).
Ames Sword Co., Chicopee, Mass.

Polishing Meal for Dry Tumbling
Peckham Mfg. Co., Newark, N. J.

Potash. (See also Platers' Supplies).
International Chemical Co., Camden, N. J.
McKesson & Robbins, New York.
Niagara Alkali Co., Niagara Falls, N. Y.

Presses, Bench and Foot
Baird Machine Co., Oakville, Conn.
Blake & Johnson Co., Waterbury, Conn.
Bliss, E. W., Company, Brooklyn, N. Y.
Leiman Bros., New York.
Shuster, The F. B., Co., New Haven, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Presses, Cabbaging
Farrel Foundry & Machine Co., Ansonia, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.
Wood, R. D., & Co., Philadelphia, Pa.

Presses, Coining
Bliss, E. W., Co., Brooklyn, N. Y.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Presses, Drop
Bliss, E. W., & Co., Brooklyn, N. Y.
Oliver, W. W., Mfg. Co., Buffalo, N. Y.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Presses, Filter.
American Tool & Machine Co., Boston, Mass.

Presses, Power
Baird Machine Co., Oakville, Conn.
Blake & Johnson Co., Waterbury, Conn.
Bliss, E. W., Co., Brooklyn, N. Y.
Farrel Foundry & Machine Co., Ansonia, Conn.
Garrison, A., Foundry Co., Pittsburg, Pa.
Torrington Manufacturing Co., Torrington, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.
Watson-Stillman Co., New York.
Wood, R. D., & Co., Philadelphia, Pa.

Pressure Blowers. (See also Foundry Supplies).
Eureka Pneumatic Spray Co., New York.
Lederer, F. J., Co., Buffalo, N. Y.
Leiman Bros., New York.
Monarch Eng. Mfg. Co., Baltimore, Md.
Rockwell Furnace Co., New York.

Pyrometers.
Bristol & Co., The, Waterbury, Conn.

Riveting Machines.
Shuster, The F. B., Co., New Haven, Conn.
Wood, R. D., & Co., Philadelphia, Pa.

Rivets—Brass, Aluminum, Etc.
Hassall, John, Inc., New York.
Hendricks Bros., New York.
Kemp, W. H., Co., New York.

Roll-Grinding Machines.
Farrel Foundry & Machine Co., Ansonia, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Rolls, Chilled and Sand
Blake & Johnson Co., Waterbury, Conn.
Farrel Foundry & Machine Co., Ansonia, Conn.
Garrison, A., Fdy. & Machine Co., Pittsburg, Pa.
Torrington Manufacturing Co., Torrington, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Rolls, Jewelers'
Leiman Bros., New York.
Oliver, W. W., Mfg. Co., The, Buffalo, N. Y.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Rolling Mill Machinery.
Blake & Johnson Co., Waterbury, Conn.
Farrel Foundry & Machine Co., Ansonia, Conn.
Garrison, A., Fdy. & Machine Co., Pittsburg, Pa.
Torrington Manufacturing Co., Torrington, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Rouge. (See Platers' Supplies).

Rust-Proofing Process. (See also Galvanizing).
Flavell, A. E., New Britain, Conn.

Sand, Fire (See also Foundry Supplies).
Detroit Foundry Supply Co., Detroit, Mich.
Pangborn, Thomas W., Co., Jersey City, N. J.
Paxson, J. W., Co., Philadelphia, Pa.

Sand Blast Machinery and Equipment.
Leiman Bros., New York.
Nicholas, Wm. H., New York.
Pangborn, Thomas W., Co., Jersey City, N. J.
Paxson, J. W., Co., Philadelphia, Pa.

Sand Blast Systems
Pangborn, Thomas W., Co., Jersey City, N. J.

Sand Blast Tumbling Barrels.
Pangborn, Thomas W., Co., Jersey City, N. J.

Sand Dryers
Pangborn, Thomas W., Co., Jersey City, N. J.

Sand Handling and Conveying Machines
Pangborn, Thomas W., Co., Jersey City, N. J.

Sand Dryers, Sifters and Mixers.
(See also Foundry Supplies).
Detroit Foundry Supply Co., Detroit, Mich.
Nicholls, Wm. H., New York.
Osborn Mfg. Co., Cleveland, O.
Pangborn, Thomas W., Co., Jersey City, N. J.
Paxson, J. W., Co., Philadelphia, Pa.
Turner Machine Co., Philadelphia, Pa.

Sand, Molding (See also Foundry Supplies).
Detroit Foundry Supply Co., Detroit, Mich.
Pangborn, Thomas W., Co., Jersey City, N. J.
Paxson, J. W., Co., Philadelphia, Pa.

Sawdust, Boxwood, for Drying Purposes.
(See also Platers' Supplies).
Sommers, John, Faucet Co., Newark, N. J.

Sawdust Drying-out Boxes.
(See also Platers' Supplies).
Bennett-O'Connell Co., Chicago, Ill.
Hanson & Van Winkle Co., Newark, N. J.
Steiner, E. E., Newark, N. J.

Shears, Power
Bliss, E. W., Co., Brooklyn, N. Y.
Farrel Foundry & Machine Co., Ansonia, Conn.
Garrison, A., Fdy. & Machine Co., Pittsburg, Pa.
Torrington Manufacturing Co., Torrington, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.
Watson-Stillman Co., New York.
Wood, R. D., & Co., Philadelphia, Pa.

Sheet Metal Straightening, Cutting and Forming Machinery.
Baird Machine Co., Oakville, Conn.
Bliss, E. W., Co., Brooklyn, N. Y.
Blake & Johnson Co., Waterbury, Conn.
Farrel Foundry & Machine Co., Ansonia, Conn.
Shuster, The F. B., Co., New Haven, Conn.
Torrington Manufacturing Co., Torrington, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Sherardizing (See also Galvanizing).
Globe Machine & Stamping Co., Cleveland, O.

Sheradizing Ovens
Gehnrich, Hermann, New York.
Globe Machine & Stamping Co., Cleveland, O.
Rockwell Furnace Co., New York.

Silicon
American Smelting & Refining Co., Cincinnati, O.
Leavitt, C. W., & Co., New York.

Silicon Copper.
American Smelting & Refining Co., Cincinnati, O.
Damascus Bronze Co., Pittsburgh, Pa.
Electric Smelting & Alum'n Co., Lockport, N. Y.
Roessler & Hasslacher Chemical Co., New York.

Silver, Nitrate and Chloride of
(See also Platers' Supplies).
Jackson, John J., Co., Newark, N. J.

Silver Ingots, Bars, Plates, Etc.
Renziehausen, Wm. F., Co., Newark, N. J.

Silver, Rolled Sterling
Jackson, John J., Co., Newark, N. J.
Renziehausen, Wm. F., Co., Newark, N. J.
Riverside Metal Co., Riverside, N. J.

Silver Wire.
Jackson, John J., Co., Newark, N. J.

Smelters, Sweep
Renziehausen, Wm. F., Co., Newark, N. J.

Soap. (See also Platers' Supplies).
International Chemical Co., Camden, N. J.

Solder, Aluminum
Aluminum Company of America, Pittsburg, Pa.
American Solder Co., Boston, Mass.
Atkinson Co., The, Rochester, N. Y.
Electric Smelt. & Aluminum Co., Lockport, N. Y.
Janney, Steinmetz & Co., Philadelphia, Pa.
Kemp, W. H., Co., New York.
Richards & Co., Boston, Mass.
U. S. Reduction Co., Chicago, Ill.

Solder, Brazing
American Smelting & Refining Co., Cincinnati, O.
Fitz, Dana & Co., Boston, Mass.
Hussey, C. G., & Co., Pittsburg, Pa.
Linton & Co., Providence, R. I.
Merchant & Evans Co., Philadelphia, Pa.
National Metal Reduction Co., Cleveland, O.
Naulty Smelting & Ref'g Co., Philadelphia, Pa.
North American Smelting Co., Philadelphia, Pa.
Richards & Co., Boston, Mass.

Solder, Gold
Linton & Co., Providence, R. I.

Solder, Silver
Jackson, John J., & Co., Newark, N. J.
Linton & Co., Providence, R. I.

Solder, Tinners'
American Smelting & Refining Co., Cincinnati.
Fitz, Dana & Co., Boston, Mass.
Merchant & Evans Co., Philadelphia, Pa.
Michigan Smelting & Refining Co., Detroit, Mich.
National Metal Reduction Co., Cleveland, O.
North American Smelting Co., Philadelphia, Pa.
Richards & Co., Boston, Mass.

Spelter.
American Smelting & Refining Co., Cincinnati, O.
Birkenstein, S., & Sons, Chicago, Ill.
Damascus Bronze Co., Pittsburgh, Pa.
Fitz, Dana & Co., Boston, Mass.
Grasselli Chemical Co., Cleveland, O.
Hegeler Bros., Danville, Ill.
Hendricks Bros., New York.
Illinois Smelting & Refining Co., Chicago, Ill.
Illinois Zinc Co., Peru, Ill.
Leavitt, C. W., & Co., New York.
Matthiessen & Hegeler Zinc Co., La Salle, Ill.
Michigan Smelting & Refining Co., Detroit, Mich.
National Metal Reduction Co., Cleveland, O.
New Jersey Zinc Co., The, New York.
Richards & Co., Boston, Mass.
Sandoval Zinc Co., Chicago, Ill.
U. S. Reduction Co., Chicago, Ill.

Spinning Lathes.
Bliss, E. W., Company, Brooklyn, N. Y.
Pryibil, P., New York.

Spraying Machines.
Eclipse Air Brush & Compressor Co., Bloomfield, N. J.
Eureka Pneumatic Spray Co., New York.
Lederer, F. J., Co., Buffalo, N. Y.
Paasche Air Brush Co., Chicago, Ill.
Pangborn, Thomas W., Co., Jersey City, N. J.

Sprue Cutters. (See also Foundry Supplies).
Bliss, E. W., Company, Brooklyn, N. Y.
Middleditch, Benj., Detroit, Mich.
Nicholls, Wm. H., New York.
Shuster, The F. B., Company, New Haven, Conn.
Smith, J. D., Foundry Supply Co., Cleveland, O.
Turner Machine Co., Philadelphia, Pa.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Tacks. (See name of metal wanted).

Tanks, Electroplaters' (See also Platers' Supplies).
Chadwick-Boston Lead Co., Boston, Mass.
Corcoran, A. J., Inc., New York.
Hanson & Van Winkle Co., Newark, N. J.
Stearns, The A. T., Lumber Co., Boston, Mass.

Tin, Chloride of
Grasselli Chemical Co., Cleveland, O.

Tinning Machines
Globe Machine & Stamping Co., Cleveland, O.
U. S. Electro Galvanizing Co., Brooklyn, N. Y.

Tin, Pig, Bar and Block
American Smelting & Refining Co., Cincinnati, O.
Birkenstein, S., & Sons, Chicago, Ill.
Fitz, Dana & Co., Boston, Mass.
Hendricks Bros., New York.
Leavitt, C. W., & Co., New York.
Merchant & Evans Co., Boston, Mass.
Michigan Smelting & Refining Co., Detroit, Mich.
Richards & Co., Boston, Mass.
Standard Rolling Mills, Inc., Brooklyn, N. Y.
U. S. Reduction Co., Chicago, Ill.

Tin, Sheet Block
Merchant & Evans Co., Philadelphia, Pa.
Standard Rolling Mills, Inc., Brooklyn, N. Y.

Tramrails. (See also Foundry Supplies).
Rockwell Furnace Co., New York.

Tripoli Flour, Stone, Filters, Etc. (See also Platers' Supplies).
American Tripoli Co., Seneca, Mo.
Detroit Foundry Supply Co., Detroit, Mich.
McKesson & Robbins, New York.

Trolley Systems.
Nicholls, Wm. H., New York.

Tumbling Barrels, Leather for Dry.
Peckham Mfg. Co., Newark, N. J.

Tubes. (See name of metal wanted).

Tumbling Barrels. (See also Foundry Supplies and Platers' Supplies).
Detroit Foundry Supply Co., Detroit, Mich.
Globe Machine & Stamping Co., Cleveland, O.
Middleditch, Benj., Detroit, Mich.
Nicholls, Wm. H., New York.
Osborn Mfg. Co., Cleveland, O.
Pangborn, Thomas W., Co., Jersey City, N. J.
Paxson, J. W., Co., Philadelphia, Pa.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Type Metal.
American Smelting & Refining Co., Cincinnati, O.
Illinois Smelting & Refining Co., Chicago, Ill.
North American Smelting Co., Philadelphia, Pa.
Richards & Co., Boston, Mass.
Standard Rolling Mills, Inc., Brooklyn, N. Y.

Uraniumite
Uraniumite Co. of America, Buffalo, N. Y.

Vibrators. (See also Foundry Supplies).
Nicholls, Wm. H., New York.

Waste Washing Machines.
American Tool & Machine Co., Boston, Mass.

Wax Wire. (See also Foundry Supplies).
Stevens, Frederic B., Detroit, Mich.

Welding and Tempering Compounds
Uraniumite Co. of America, Buffalo, N. Y.

White Metal Castings.
Electro Bronze Co., Arlington, N. J.
Standard Rolling Mills, Inc., Brooklyn, N. Y.

White Metal Rolling for the Trade.
Standard Rolling Mills, Inc., Brooklyn, N. Y.

Wire. (See name of metal wanted).

Wire Goods Manufacturers.
Baird Machine Co., Oakville, Conn.
Campbell-Warner Co., Middletown, Conn.

Wire Mill Equipment.
Blaké & Johnson Co., Waterbury, Conn.
Farrel Foundry & Machine Co., Ansonia, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Wire Nails, All Metals.
John Hassall, Inc., New York.

Wire Straightening and Forming Machinery
Baird Machine Co., Oakville, Conn.
Blake & Johnson Co., Waterbury, Conn.
Bliss, E. W., Co., Brooklyn, N. Y.
Pangborn, Thomas W., Co., Jersey City, N. J.
Shuster, The F. B., Co., New Haven, Conn.

Wire Wheel and Hand Brushes. (See also Foundry Supplies).
Blumenthal, Hermann, & Co., New York.
Manufacturers' Brush Co., Cleveland, O.
Osborn Mfg. Co., Cleveland, O.
Paxson, J. W., Co., Philadelphia, Pa.
Riehl Manufacturing Co., Cleveland, O.

Zinc Battery Plates.
Grasselli Chemical Co., Cleveland, O.
Matthiesen & Hegeler Zinc Co., La Salle, Ill.

Zinc, Chloride of (See also Platers' Supplies).
Grasselli Chemical Co., Cleveland, O.
Richards & Co., Boston, Mass.
Sandoval Zinc Co., East St. Louis, Ill.

Zinc Dust (See also Platers' Supplies).
Globe Machine & Stamping Co., Cleveland, O.
Grasselli Chemical Co., Cleveland, O.
Leavitt, C. W., & Co., New York.
McKesson & Robbins, New York.

Zinc Salts, Commercial (See also Platers' Supplies).
Sandoval Zinc Co., East St. Louis, Ill.

Zinc Sheet and Plate.
Illinois Zinc Co., Peru, Ill.
Matthiesen & Hegeler Zinc Co., La Salle, Ill.
Merchant & Evans Co., Philadelphia, Pa.
National Sheet Metal Co., Peru, Ill.
Pilling Brass Co., Waterbury, Conn.
Richards & Co., Boston, Mass.

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